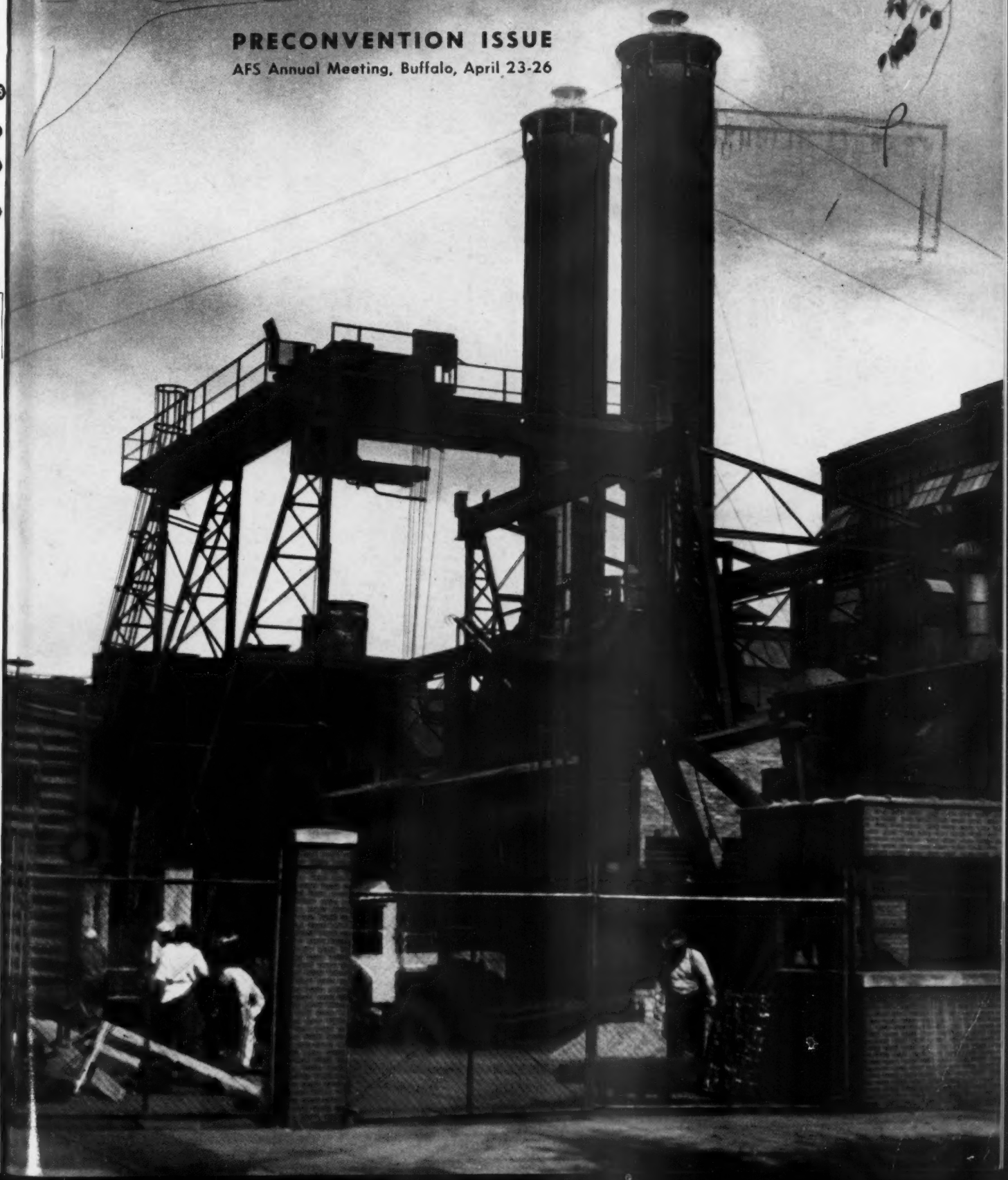
APRIL 1951

FOUNDRY

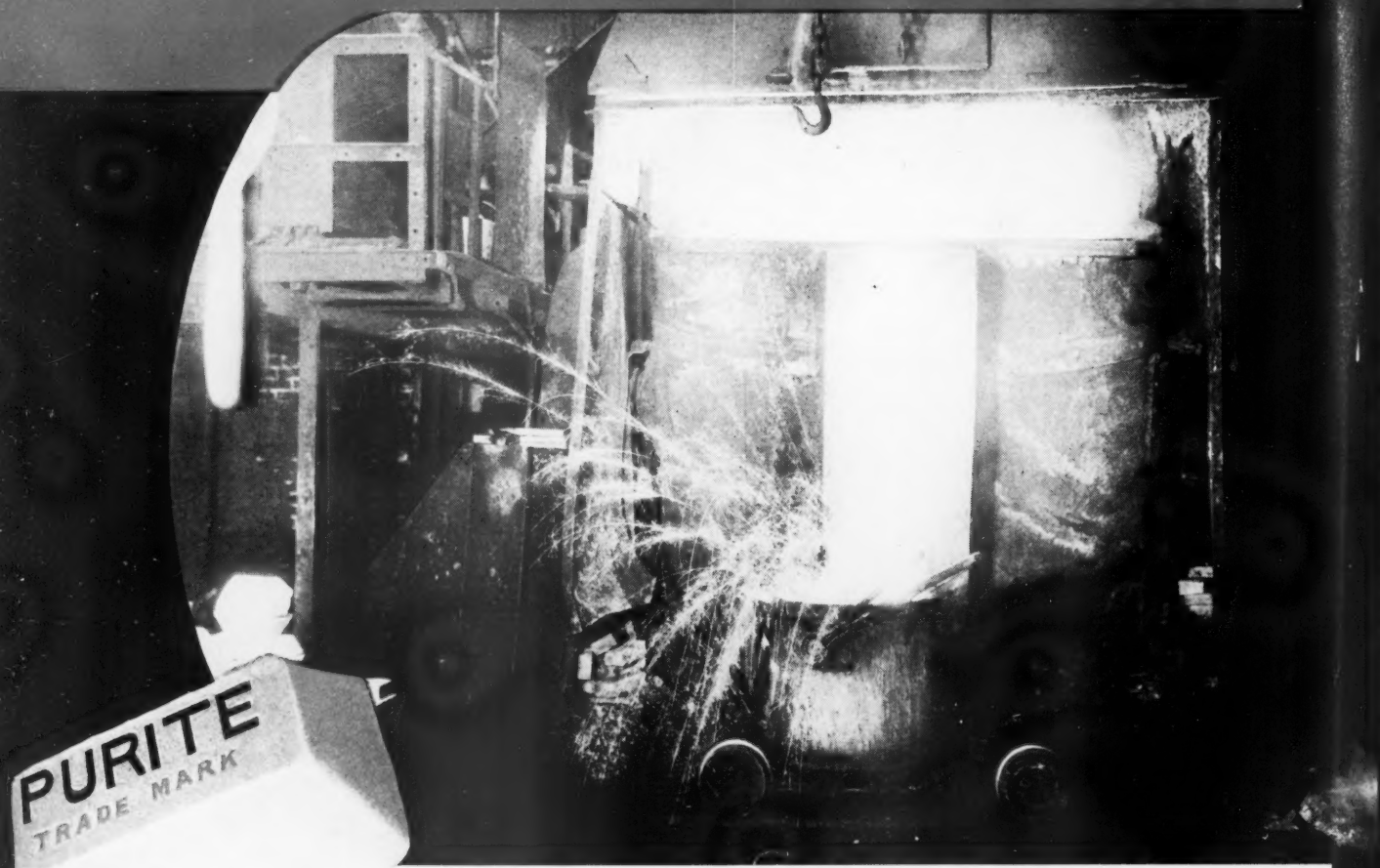
PRECONVENTION ISSUE

AFS Annual Meeting, Buffalo, April 23-26



refine with PURITE

FOR CLEANER...SOUNDER IRON CASTINGS



St. Louis Plant of American Car and Foundry Company

where quality castings are made for modern heavy railroad equipment.

To produce the best castings possible, leading foundries like the American Car and Foundry Company refine their iron with Purite. Applicable both as a cupola flux and as a ladle desulphurizing agent, Purite has won industry-wide acceptance because:

- Purite gives 100% fluxing action in the cupola — 100% desulphurizing action in the ladle.
- Purite gets to the iron quicker — no faster desulphurizer made.
- Purite is time-tested and proven for unsurpassed desulphurizing uniformity.
- Purite comes in 2-lb. pigs — no weighing or measuring required.
- Purite is 100% fused soda ash — you do not pay for inert materials.
- Purite does not crumble — no waste — no dust.
- Purite can be shipped in bulk carloads at substantial savings over bag shipments — is easily stored without deterioration.

These advantages and many more, proved through its everyday use in iron foundries, have made Purite the universal cupola flux and ladle desulphurizing agent.

A new booklet, "Refining and Desulphurizing Cupola Iron," illustrates in detail the accepted ways in which Purite is most effective. Write for your copy today. Mathieson Chemical Corporation, Mathieson Building, Baltimore 3, Maryland.

PURITE — 100% Fused Soda Ash. The Scientific Flux for Better Melting and Cleaner Iron.

PURITE — is sold by all leading foundry supply houses in the United States and Canada.

Mathieson
CHEMICALS

8949

SERVING INDUSTRY, AGRICULTURE AND PUBLIC HEALTH

TECHNOLOGY DEPT.

DUCTILE IRON

A Revolutionary Metallurgical Development

PUBLIC LIBRARY
APR 2 1951
DETROIT

DUCTILE IRON is a cast ferrous product which combines the *process advantages* of cast iron with many of the *product advantages* of cast steel.

No longer in the pilot-plant stage, this new material is now produced and sold on the basis of specifications. Not only are its individual properties exceptional, but no other common engineering material provides such a combination of excellent castability and fluidity, with high strength, toughness, wear resistance, and machinability.

Actually, "ductile iron" denotes not a *single* product, but rather a family of ferrous materials characterized by graphite in the form of spheroids . . . a form controlled, in a broad sense, by small amounts of magnesium. Presence of spheroidal rather than flake graphite gives this new product a ductility that is unique among gray cast irons.

Four important types of ductile iron now being produced commercially are tabulated below.

REPRESENTATIVE MECHANICAL PROPERTIES OF COMMERCIAL HEATS OF DUCTILE IRON

	Grade	Tensile strength, psi	Yield strength, psi	Elongation per cent	BHN	Usual condition
A	90-65-02	95/105000	70/75000	2.5/5.5	225/265	As-cast
B	80-60-05	85/95000	65/70000	5.5/10.0	195/225	As-cast
C	60-45-15	65/75000	50/60000	17.0/23.0	140/180	Annealed
D	80-60-00	85/95000	65/75000	1.0/3.0	230/290	As-cast

A Pearlitic in structure. Provides good mechanical wear resistance.

B Pearlitic-ferritic in structure. Provides strength and toughness combined.

C A fully ferritic structure usually obtained by short anneal of either (A) or (B). Provides optimum machinability and maximum toughness.

D Higher phosphorous content than preceding grades, also higher manganese. Provides high strength and stiffness, but only moderate impact strength.

SOME UNIQUE PROPERTIES OF DUCTILE IRON

1. Its elastic modulus, about 25,000,000 psi, is virtually unaffected by composition or thickness . . .

2. It can provide a chilled, carbidic, abrasion-resistant surface supported by a tough ductile core. No other single material can combine these properties . . . its only counterpart being a tough material coated with a hard welded overlay.

3. As-cast ductile iron of 93,000 psi tensile strength has the same machinability rating as gray iron with a strength of 45,000 psi.

4. Annealed ductile iron can be machined at a rate 2 to 3 times that of good quality gray iron.

5. It can be satisfactorily welded.

APPLICATIONS

Automotive, agricultural implement, railroad and allied industries apply ductile iron, as-cast and heat treated, in components too numerous to detail.

Machinery, machine tools, crankshafts, pumps, compressors, valves and heavy industrial equipment such as rolls and rolling mill housings, utilize its high strength and rigidity.

In scores of engine, furnace and other parts serving at elevated temperatures, it provides oxidation and growth resistance heretofore unavailable in high carbon castings.

Other applications include paper, textile and electrical machinery, marine equipment, and pipe.

AVAILABILITY

Send us details of your prospective uses, so that we may offer a list of sources from some 100 authorized foundries now producing ductile cast iron under patent licenses. Request a list of available publications on ductile iron . . . mail the coupon now.

EMBLEM OF INCO SERVICE
TRADE MARK

The International Nickel Company, Inc.
Dept. TF, 67 Wall Street
New York 5, N. Y.
Please send me a list of publications on:

DUCTILE IRON

Name _____ Title _____

Company _____

Address _____

City _____ State _____

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

IT TAKES BOTH

SPEED AND STRENGTH

TO

WIN WARS

Photo—Harold M. Lambert

. . . to make a good Bentonite!

Just as armies need speed and strength for victory, so foundries need them for production. Hundreds of foundries get them both—in every bag, in every ton, in every carload of Federal Green Bond they use.

Green Bond is the ideal foundry bentonite. Uniform grinding means high-speed blending with sand—you can't beat it for today's new faster mullers. High strength spells economy—a little goes a long way.

When you think of bentonite, remember this: You can't buy a better bentonite than Federal Green Bond!

THE FEDERAL FOUNDRY SUPPLY COMPANY

Seacoal Plant **4600 East 71st Street • Cleveland 5, Ohio** Mines

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NADA—Overseas Commodities Ltd., 2845 Grandview Hgy., Vancouver, B.C. • T. D. Barnes, 59 Sun Life Bldg., Hamilton, Ont. • Newman Foundry Supply, Ltd., 643 St. Paul St.W., Montreal, Q

European Concessionaires: The District Chemical Company, Ltd., 1-19 New Oxford St., London W. C. 1, England

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INDUCTOL has been proved

in 50 production foundries where baking problems had existed. If you have a special baking problem, ask your LINOIL *man about* INDUCTOL *—he'll be happy to arrange for a demonstration.*

HAVE YOU A BAKING PROBLEM THAT ORDINARY CORE OILS CAN'T SOLVE?

★ INDUCTOL ...the New, "Pre-baked" Core Oil!

WANT CORES TO BAKE FASTER?

Are your core ovens a bottleneck for your foundry? The quickest way to increase oven capacity is to cut down on the time a core occupies oven space. INDUCTOL allows you to do this, because INDUCTOL bakes rapidly—30 to 50% faster than even the fastest conventional core oils. Some foundries have doubled their core production by switching to INDUCTOL!

NEED TO BAKE AT 350°?

If, for example, you're casting magnesium, you have to bake cores at temperatures that won't drive off the inhibitors. INDUCTOL can bake at 350°—bake thoroughly and quickly. This lower baking range of INDUCTOL is good for many coke-fired ovens or for over-night baking, too!

LOOKING FOR BETTER COLLAPSIBILITY?

INDUCTOL is specially right for non-ferrous and malleable iron work—where quick collapsibility is a must. Because INDUCTOL bakes so rapidly, it burns out instantly at temperatures above 800°. Certain core rooms have found that they could eliminate the use of wood flour in their INDUCTOL cores.

★ INDUCTOL IS DIFFERENT—

a new product development of the LINOIL Research Laboratory. INDUCTOL is a chemically modified drying oil: during its manufacture, high pressure and temperature conditions serve to pre-polymerize the oil . . . essentially causing it to become "pre-baked". This pre-baked feature allows INDUCTOL to harden rapidly at temperatures between 350° and 450°.

INDUCTOL—BALANCED CORE ROOM PERFORMANCE

- ★ FASTER BAKING
- ★ ADDED GREEN STRENGTH
- ★ GOOD COLLAPSIBILITY

GET THE FACTS—*send for your* INDUCTOL *booklet today. It contains helpful information based on actual use in production.*

ASK YOUR LINOIL MAN ABOUT

INDUCTOL

ARCHER-DANIELS-MIDLAND COMPANY
(The Werner G. Smith Co. Division) • 2191 West 110th Street, Cleveland 2, Ohio

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(THE WERNER G. SMITH COMPANY DIV.)
2191 West 110th Street • • Cleveland 2, Ohio

Please send me Bulletin No. F-108.

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Company .....

Street .....

City and Zone ..... State .....

SPEED UP
CLEANING of LARGE CASTINGS

If cleaning large castings is a *s-l-o-w* process in your plant—*speed up* your cleaning operation with a Pangborn Air Blast Cleaning Room!

Work can be loaded or unloaded from *both* ends and heavy, cumbersome castings are quickly and easily handled with either a car or overhead conveyor. Large castings are cleaned in a jiffy, assuring you a *smooth flow of work* from shakeout, through cleaning and on to grinding and inspection.

Pangborn has *job-proven* Air Blast Room designs to meet all cleaning requirements. Features include plenty of illumination on the work, automatic abrasive recovery which removes sand, refuse and dust *before* returning abrasive for re-use.

For Full Details on Pangborn Air Blast Cleaning Rooms for your plant, write today to: PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Maryland.

Look to Pangborn for the Latest Developments in Blast Cleaning and Dust Control Equipment

MORE THAN 25,000 PANGBORN MACHINES SERVING INDUSTRY

Pangborn*

*Trademark of Pangborn Corporation

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

BLAST CLEANS CHEAPER with the right equipment for every job

ADVERTISEMENT

If you haven't heard it . . . IT'S NEWS!

We're in favor of government controls—on taxes, that is.

* * *

Worry is like a rocking chair: it gives you something to do but it doesn't get you anywhere.

* * *

It's all how you look at it. Some folks complain because raspberry bushes have thorns. Others see the sunny side and are happy that the thorn bushes have raspberries.

* * *

The experts who go around measuring these things tell us that noise costs American business $4,000,000 a day (in accidents and errors). Many industries have installed noise control with impressive and highly profitable results.

* * *

This puts noise in the same class with dust. Industrial dust also cuts into profits and to control it costs only a fraction of what it costs to put up with it. If you have a dust problem it will pay you to drop Pangborn a post card today.

* * *

There's nothing like buying a second-hand car to make you realize how hard it is to drive a bargain.

* * *

How quick is a wink? Scientists tell us that the average wink lasts .3 of a second and happens 2.8 seconds apart. A little rapid calculation discloses that this means the average person goes through life with his eyes shut 11% of his waking time.

* * *

Guess a man can't help blinking. But on the other hand, there's no excuse for going through life with your eyes shut to a good thing—like Pangborn Rotoblast. Read the Pangborn ads: modern blast cleaning pays for itself in lower labor costs alone.

* * *

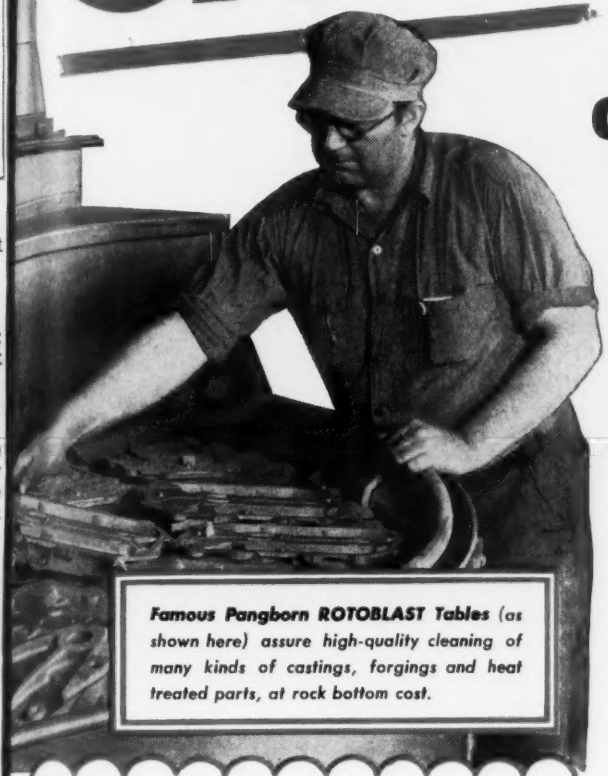
Snappy comeback: what most of us think of five minutes too late.

* * *

Now we can all breathe easier: the U. S. Fish and Wildlife Service has just announced that there are only 811 grizzly bears in the United States.

SAVE SAVE SAVE

on BLAST CLEANING with PANGBORN ROTOBLAST*



Famous Pangborn ROTOBLAST Tables (as shown here) assure high-quality cleaning of many kinds of castings, forgings and heat treated parts, at rock bottom cost.

BY THE WEEK: One foundry, with ROTOBLAST, slashes *$211.56* every week off their blast cleaning bill. An additional saving in this case is *lower breakage losses*—important in any foundry producing intricate and fragile castings.

BY THE MONTH: One more foundry credits ROTOBLAST with saving $423.30 *each month* on blast cleaning. To prove that blast cleaning goes faster with ROTOBLAST, castings are now cleaned in 1/3 the time it used to take!

BY THE YEAR: $10,160 saved on labor alone each year—that's the story from a large ROTOBLAST-equipped foundry. But there are still more savings: five old-fashioned machines with bothersome dust have been completely eliminated—important for a foundry where space is at a premium!

Find out how much you can save! If you're hampered by old-fashioned blast cleaning methods, you can *save money* with ROTOBLAST. There's a modern, economical, efficient ROTOBLAST *Barrel, Room, Table* or *Table-Room* especially designed to solve every blast cleaning problem. Let Pangborn engineers show what ROTOBLAST can do for you. Write today for Bulletin 214 to PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Maryland.

Look to Pangborn for the Latest Developments in Blast Cleaning and Dust Control Equipment

ROTOBLAST makes cash savings possible these five different ways:

SAVES LABOR: *One ROTOBLAST machine and operator can do as much as a two-man crew and old-fashioned equipment.*

SAVES SPACE: *In many cases, one ROTOBLAST machine replaces five or more old-fashioned machines, requires less space.*

SAVES TIME: *Cases on record prove ROTOBLAST can cut cleaning time up to 95.8% compared to older methods.*

SAVES POWER: *Modern ROTOBLAST uses but 15-20 h.p. compared to old-fashioned equipment requiring 120 h.p. for same job.*

SAVES TOOLS: *On work cleaned with ROTOBLAST, cutting tools last up to 3 times longer because no scale is left to dull edges.*

SAVINGS mean PROFITS

MORE THAN 25,000 PANGBORN MACHINES SERVING INDUSTRY

Pangborn

*Trademark of Pangborn Corporation

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION MEMBER FEMA

BLAST CLEANS CHEAPER with the right equipment for every job

ABROAD—as at home..

Champion

AZIENDE INDUSTRIALI VITTORIO NECCHI
MACCHINE PER CUCIRE
PAVIA (Italia)

UFFICIO VENDITA ESTERO

15 Dicembre 1950

Rif. 4231/250/CR

Messrs. CHAMPION FOUNDRY & MACHINE CO.
1553, W. Madison Street
CHICAGO 7 Ill. U.S.A.

Riferendoci alla fornitura di macchine a soffiare da Voi eseguita, dopo un anno di ininterrotto funzionamento siamo lieti di comunicarVi la nostra soddisfazione per la regolarita di lavoro ed i risultati qualitativi e quantitativi delle anime prodotte.

Esse hanno superato le nss. aspettative dimostrandosi superiori ai tipi fino ad oggi usati nellanostra fonderia.

Ci complimentiamo inoltre con Voi per la competente assistenza accordataci dal Vostro Rappresentante per l'Italia, Ditta Fratelli Musso di Torino.

Ci e grata l'occasione per porgerVi i nostri distinti saluti.

VITTORIO NECCHI S. p. A.
GHISA MALLEABILE
Il Direttore
(Ing. G. Rossi)

Wherever Champion Core Blowers are in operati reports from users are uniformly enthusiastic in rega to performance, production, quality of product, economy. The letter reproduced at the left, recei recently from one of our overseas customers, is a typ example. The translation follows:

Gentlemen:

Reference is made to your Core Blower Machines' shipments and after one year of continuous functio ing we are happy to inform you of our complete sa isfaction of the results not only for quality but also for the quantity of the work produced.

They have surpassed all our expectations proving t be superior to any other machine of the same type used in our foundry.

We compliment you for your excellent and compet assistance together with your representative Fratelli Musso S. A. of Torino.

We take this opportunity to give you our sincere regards.

Yours very truly,
VITTORIO NECCHI S.p.A.
GHISA MALLEABILE
il Direttore

s/Ing. G. Rossi

Core room of the Necchi foundry, showing two CB 15 core blowers in foreground; behind them are two CB 10's. Conveyor at left of machines runs under the horizontal core oven.

...Core Blowers

EXCEL in quality... in quantity!

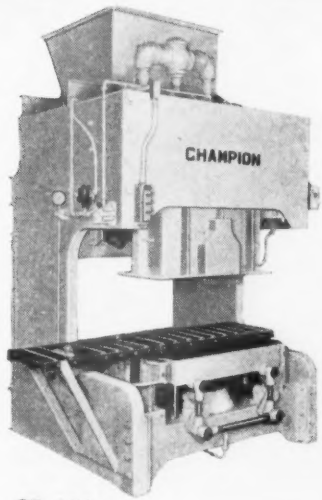
THEY'RE FAST The largest as well as the smallest Champion will fill any core box with well rammed sand as fast as the operator can place and remove it.

THEY'RE EASY TO OPERATE Effortless control is one feature of Champions that makes them high favorites of operators. Just an easy movement of the air valve, and whoosh! the box is filled.

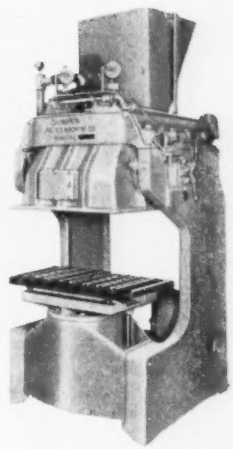
THEY'RE ACCURATE Every core comes out clean and true to the exact contour of the box. Large sectional cores are assembled without jigging or grinding.

THEY'RE ECONOMICAL Standard 85 lb. air lines, no boosters, are adequate to assure positive operation. Large cores are blown in one piece.

When Champions go in, big savings always follow. Let us give you a few "case histories." Write us, today.



CB 400



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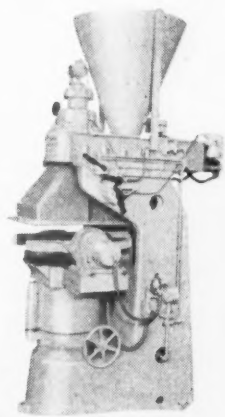

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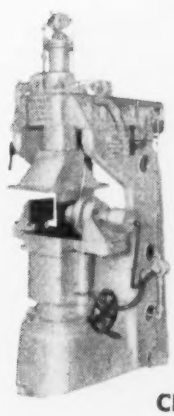

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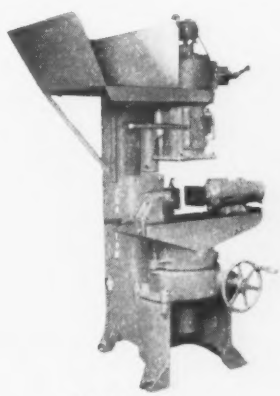
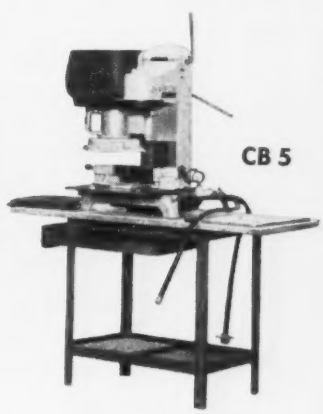


CB 10



CB 5

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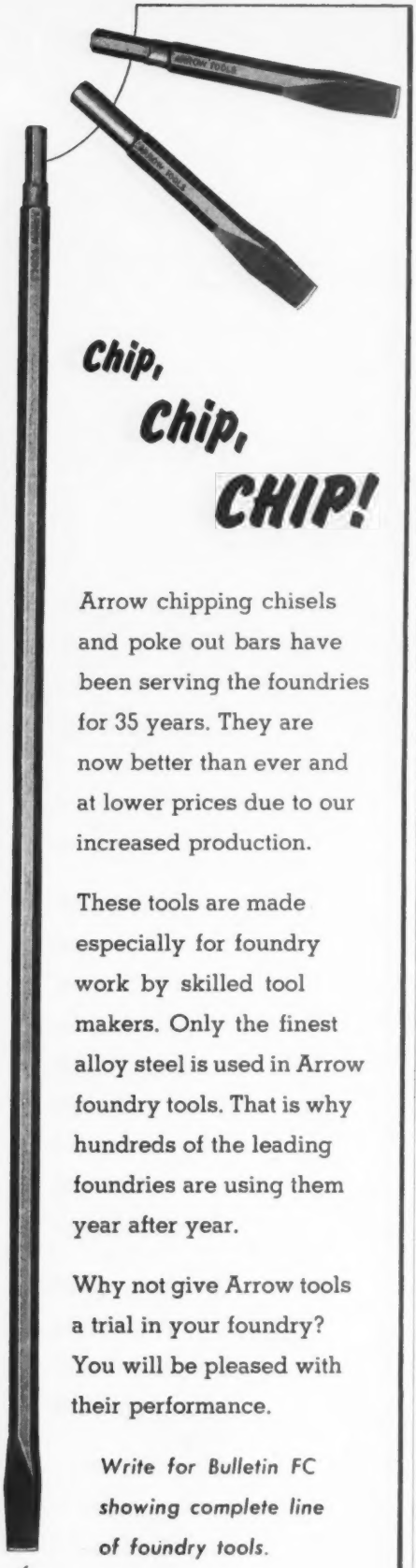


Chip,
Chip,
CHIP!

Arrow chipping chisels and poke out bars have been serving the foundries for 35 years. They are now better than ever and at lower prices due to our increased production.

These tools are made especially for foundry work by skilled tool makers. Only the finest alloy steel is used in Arrow foundry tools. That is why hundreds of the leading foundries are using them year after year.

Why not give Arrow tools a trial in your foundry? You will be pleased with their performance.

Write for Bulletin FC showing complete line of foundry tools.

ARROW TOOLS inc.
1900 S. KOSTNER AVE., CHICAGO 23

With the EDITORS

CONVENTION: While the winter's snows have melted and Lake Erie is free of ice, it hardly seems possible that the annual AFS convention is so close at hand. But in a little less than three short weeks after this issue reaches you, we will all be off to Buffalo to attend the off-year technical and business meeting of the society. The program presented as a part of the Buffalo convention story starting on page 102 indicates much of interest for the industry.

As is usual, FOUNDRY will have most of its editorial and business staffs on hand to greet old friends and prepare convention reports for the June Post-Convention issue. Editors will include Frank Steinebach, Bill Gude, Ed Bremer, Pat Dwyer, Bob Herrmann, Erle Ross, Virginia Taylor and Virginia Harms. Business representatives will include George Pope, Jack Lathrop, Jack Ahrens, Al Klingeman, Al Johansen and Bob Chew. We are looking forward to seeing you.

—o—

Cover: When the editors got together some weeks back to discuss the cover for the preconvention issue, everybody thought we should do something special. The idea of an overall four-color process job showing some foundry scene found considerable favor and the job of locating just the right photograph got under way. Remembering the beautiful color motion picture "This Moving World," produced by the Malleable Founders' Society and shown widely by the society and members during the past two years, we considered the possibility of blowing up a single shot from this film. Lowell Ryan, managing director, offered to loan the film at any time.

Experts at Eastman's in Rochester and at our local engravers pointed out that such movies are produced at a relatively slow camera speed, and that the detail in the individual frames probably would not be as clearly defined as desired for cover purposes. They suggested the possibility of stills taken at the same time and with the same lighting as the movies. Checking the plants where the movies were produced, we found that stills were made at Belle City Malleable Iron Co., Racine, Wis., while a part of "This Moving World" was being produced there.

Through the kind co-operation of Charles S. Anderson, president, and E. O. (Penny) Jones, personnel director of Belle City, we were able to go over about 40 such stills and select a half dozen interior and exterior views for the final judging. Then we called in all the experts(?) in the editorial and art departments. Perhaps thoughts of spring—blue sky—warm days—and the great outdoors had something to do with the selection of the photo reproduced on the cover of this issue. It shows the plant gate and several cupolas, and the shot is very similar to one that appears in the society movie. We think it makes a dandy cover, thanks to Belle City.

—o—

PFL: These initials which we use constantly around the office, refer to *Penton's Foundry List,* that complete listing of foundries in the United States and Canada which is published every two years by FOUNDRY. Business Manager George Pope tells us that work on the new edition is moving along nicely, and that the 1951-52 issue will be ready for delivery sometime during the summer. Publication of PFL provides considerable data for studies of the foundry industry. The first, giving the total number of foundries in the various industry divisions, and complete breakdowns by states, will appear in FOUNDRY during the summer.

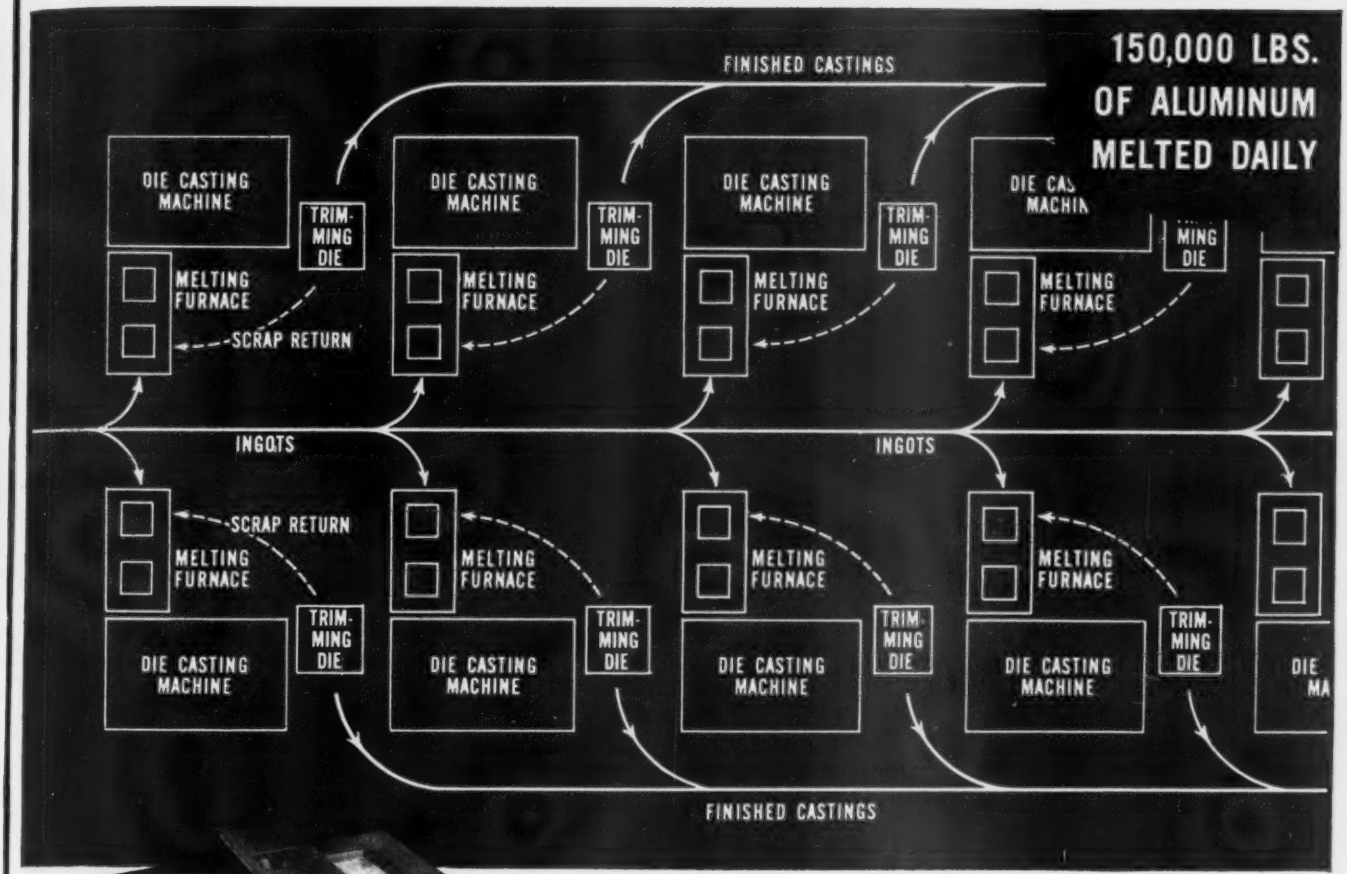
—o—

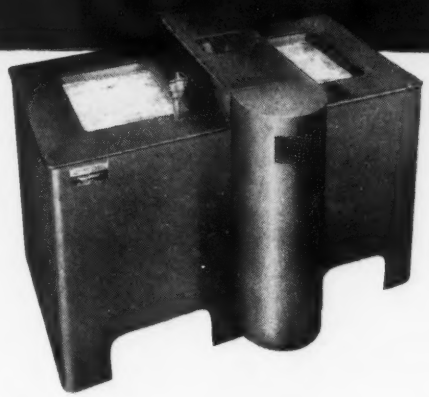
Wrong Number: The editor of a business paper serving another field recently received a letter from a subscriber asking for information on "magnesium ladles." This editor sent Bill Gude a hurry-up call for help, but Bill could not quite figure out the angle. So the subscriber was queried for further information, and then it developed that a steno made a little mistake. It was "ladders" not "ladles."

—o—

Benners Hill: Folks out in San Francisco are very proud of the view of the city and its surroundings from the "Top of the Mark" and rightly so, for it is a glorious sight. Several weeks ago the editor was given a similar treat at Birmingham. Tom and Mrs. Benners invited a group of regional conference visiting firemen

(Concluded on page 12)





15 LINDBERG 2-CHAMBER FURNACES IN ONE DIE-CASTING PLANT....

One of the nation's newest die-casting plants uses 15 Lindberg Two-Chamber Furnaces in their die casting operations. These furnaces, operating on a 24 hour a day schedule have the capacity to melt 150,000 lbs. of alloy per day. Each furnace serves a separate die casting machine to produce these production advantages . . .

No melting room needed—all metal is melted at the casting machine, eliminating the need for carrying hot metal through the plant.

No scrap sorting—scrap metal and reject castings never leave the machine, allowing the use of a different alloy in each machine if necessary, while completely eliminating scrap sorting, handling and identification problems.

Unified production unit—each die casting machine becomes a unified production unit—receiving cold alloy ingot, melting, holding, casting, inspecting, reclaiming scrap metal and reject castings—delivering only the finished casting to the production line. Obviously the savings realized are spectacular.

LINDBERG-Fisher MELTING FURNACES

Lindberg Engineering Co., 2543 W. Hubbard Street, Chicago 12, Illinois

They pinned a medal on "BILL"

That bright suggestion of switching to Simonds Abrasive Company grinding wheels sure paid off for Bill. Output's up and costs are down. The production line is clicking like clockwork and the boss is pleased. Maybe there's an operation in *your* plant that can be done more efficiently and economically by using Simonds wheels, slightly different, but more adaptable to your jobs. Everything in our complete line is accurately specified . . . grinding wheels, mounted wheels and points, segments, abrasive grains. Write for free data book and the name of the Simonds distributor ready to serve you.

SIMONDS ABRASIVE CO.
grinding wheels

SIMONDS ABRASIVE COMPANY, PHILADELPHIA 37, PA.
DISTRIBUTORS IN ALL PRINCIPAL CITIES

Division of Simonds Saw and Steel Co., Fitchburg, Mass. Other Simonds Companies: Simonds Steel Mills, Lockport, N. Y., Simonds Canada Saw Co., Ltd., Montreal, Que. and Simonds Canada Abrasive Co., Ltd. Arvida, Que.

(*Concluded from page* 10)

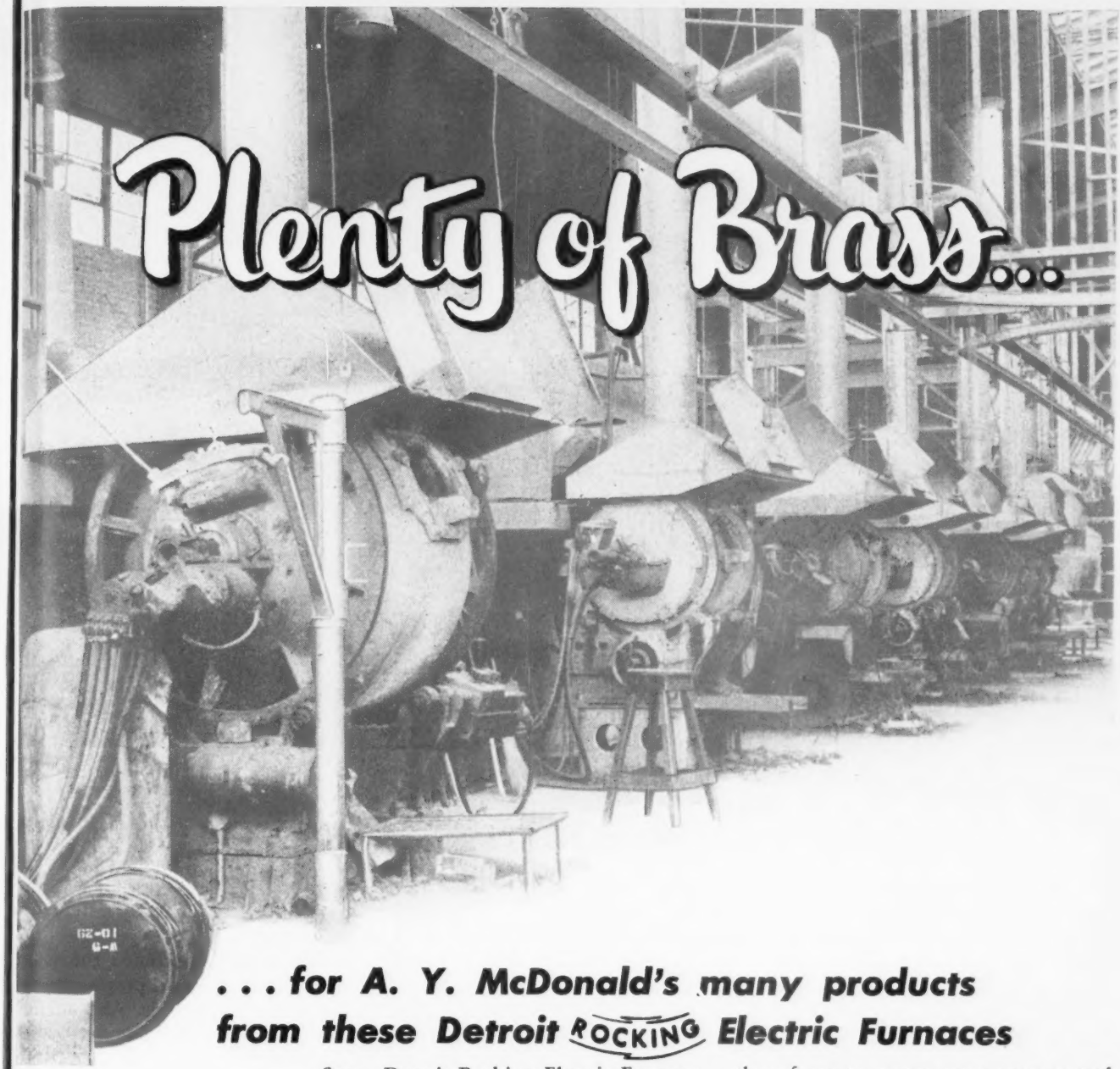
to their home on Red Mountain, and from that vantage point we saw the lights come on over the city, with the glow from the bessemer at T C & I as a background. It was lovely, so we dubbed it "Benners' Hill" and resolved to take another look the next time we visit Birmingham.

—o—

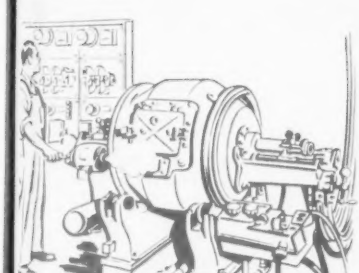
Millions of Tons: We keep telling you that the foundry industry is a great consumer of raw materials, and now the American Iron & Steel Institute comes along to confirm some of our boasting. During the past ten years, according to the institute, blast furnaces have supplied the 3000 ferrous foundries a total of 54 million tons of pig iron, a shipment requiring more than 1 million freight cars. These foundries have used the pig iron, along with ferrous scrap, to produce approximately 126 million tons of gray iron, malleable iron and steel castings from small toys to huge castings for special machinery. The institute also points out that the pig iron supplied foundries constitutes about 10 per cent of blast furnace production.

—o—

Publicity: Ever notice how many times foundries and castings are featured in the news? For example, on one recent March day we noted several interesting features—some good and some critical. *Newsweek,* in the section devoted to "Art," had a story on a lady artist of the modern school who was "exploiting the space that surrounds and fills physical arts" with the use of the welding torch. Her comment on our favorite method of fabrication follows: "There's something sham about casting your sculpture. When it comes out of the mold it's never quite the way you intended it." From the appearance of the statue this "Rosie" was working on in the illustration accompanying the article, she certainly did not intend much when she started out. Our second experience of the day was a pictorial story in the wife's hometown paper on Evangeline Aldrich, who claims the distinction of being the only woman in the country who operates a bell foundry. Four photographs were reproduced to show process and product. That evening the Jack Haley television program sponsored by Ford carried an interesting illustration of "the advance method in casting the Ford V8 and Six blocks." The "commercial" was interesting, but it brought out the fact that some research should be devoted to finding the mold material which shows up best in television.—F. G. S.



. . . for A. Y. McDonald's many products from these Detroit ROCKING Electric Furnaces



Faster melts— better melts—
ROCKING ACTION DOES IT!

Seven Detroit Rocking Electric Furnaces in the foundry of A. Y. McDonald Company, Dubuque, melt the brass used in the products of this well-known manufacturer.

In this plant, as in hundreds of others throughout the country, Detroit Electric Furnaces deliver high-quality, uniform melts with great speed and efficiency day after day.

ROCKING ACTION

This exclusive feature makes for faster melts, more economical use of heat, minimizes the possibility of segregation. Close control of the rocking cycle, possible with these furnaces, means more exact control of melt characteristics, duplication of desired results through melt after melt.

RESULTING ECONOMIES

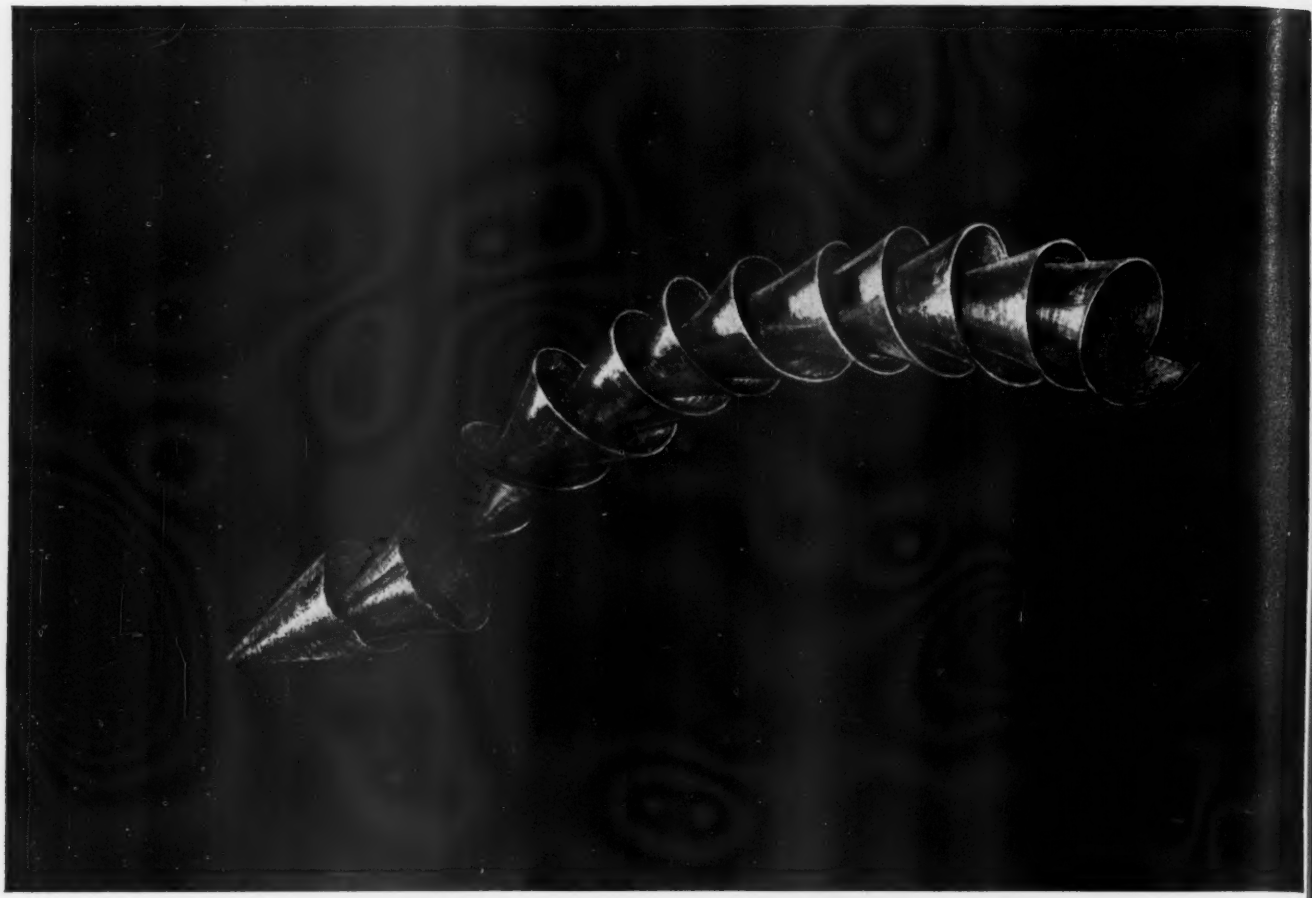
Better melts mean better castings, fewer rejects. More complete use of power means lower power costs. Better design results in less down time, lower maintenance costs.

Detroit Electric Furnaces are available in capacities from 10 to 4000 lbs. for ferrous or non-ferrous melting. Send your data. Let us show you the benefits you can have with Detroit Electric Furnaces!

DETROIT ELECTRIC FURNACE DIVISION

KUHLMAN ELECTRIC COMPANY • BAY CITY, MICHIGAN

Foreign Representatives: In BRAZIL—Equipamentos Industrias "Eisa" Ltd., Sao Paulo; CHILE, ARGENTINA, PERU and VENEZUELA: M. Castellvi Inc., 150 Broadway, New York 7, N. Y.; MEXICO: Casco, S. de R. L. Atenas 32, Despacho 14, Mexico City, D. F.



TURN SHAVINGS INTO SAVINGS!

There are several ways foundries today can conserve metals, reduce costs, and increase profits...through the adoption of the Croning Process. This "C" Process utilizes special BAKELITE Phenolic Bonding resins for the rapid heat-setting of *thin-shell* sand molds and cores.

Foundries are reporting tolerances of .002 to .005 of an inch per inch on parts cast by this process. Besides, the castings possess wellnigh pattern-smooth surfaces.

Such castings conserve metals by greatly reducing the amount of machining required, often just a finish cut being needed. They conserve metals by minimizing rejects. Whether you cast ferrous or non-ferrous metals, these thin-shell molds and cores will reduce your scrap pile—or your customers' if they do the finishing—and pile up greater production instead!

Because of their dimensional stability and excellent moisture resistance, thin-shell molds and cores can be stored for long periods, raising production efficiency by letting you build up inventories to match anticipated quotas of metal and demands for output.

Of utmost importance, too, is the time saved by rapid preparation of the cores and molds. And further time and energy are saved by the fact that you handle no more than 10 per cent of the sand normally handled.

Why not investigate fully this technically advanced method of casting. Write Department BW-29 using the coupon provided for your convenience.

Dept. BW-29, BAKELITE COMPANY,
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.

Please mail at once my free copy of the booklet, "BAKELITE Phenolic Resins for the Croning Process."

*Name*_____ *Title*_____

*Company*_____

*Street*_____

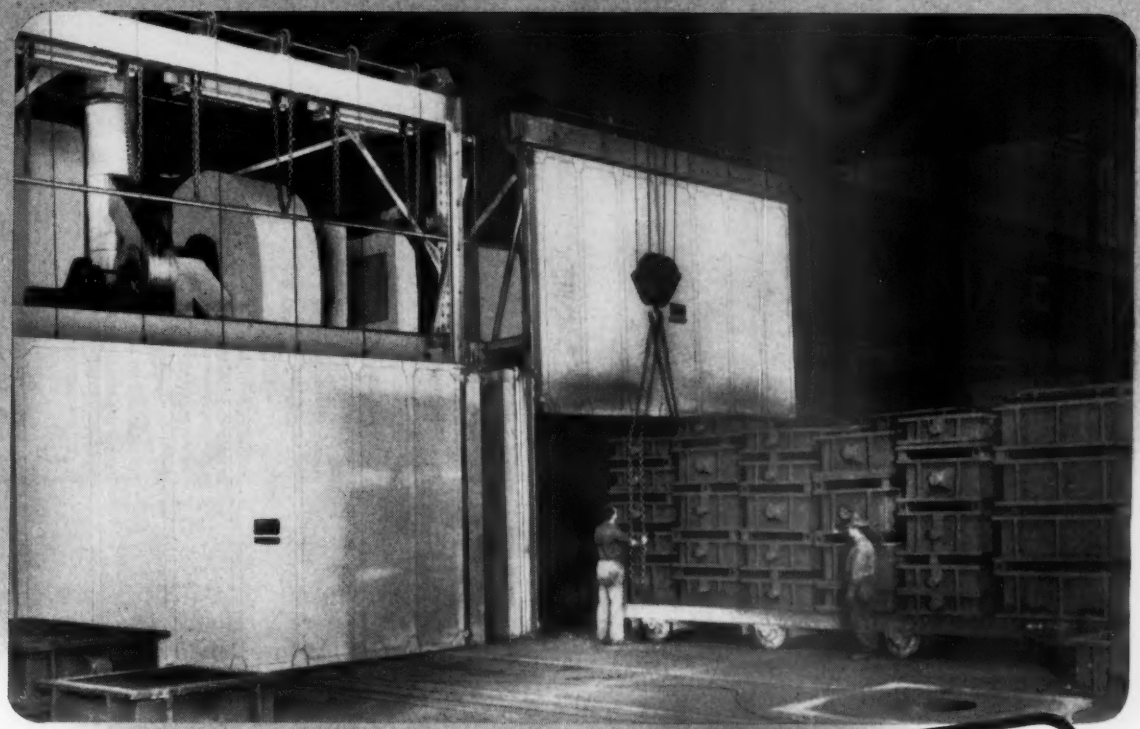
*City*_____ *State*_____

BAKELITE
TRADE-MARK
PHENOLIC
BONDING RESINS

TRADE MARK

BAKELITE COMPANY
A Division of
Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N.Y.

for perfect mold drying
COLEMAN OVENS



Coleman Car Type Mold Ovens in foundry of large engine manufacturer

● **Coleman Car Type Mold Ovens dry molds with the speed and uniformity required for increased production of quality, true-to-pattern castings in dry sand. Perfect drying eliminates mold and casting scrappage, saves valuable materials, time, and manpower.**

Coleman Car Type Core Ovens, for large, heavy core work, are the acknowledged leaders in dependable, economical performance... used by leading foundries in every class of heavy castings production.

Coleman Oven Cars are equipped with specially designed roller bearings to carry maximum loads under the severe conditions of foundry oven service. Motorized car haulage equipment can be furnished. Write for Bulletin 48

Only COLEMAN OVENS offer all these advantages:

- **PERFECT DRYING AND BAKING** eliminate manpower and casting losses due to make-overs and rejects.
- **INCREASED PRODUCTION** by making the most efficient use of skilled and unskilled labor.
- **HEAVY DUTY CONSTRUCTION.** Responsible for dependable performance, economical operation, and minimum maintenance cost.
- **GREATEST SAVINGS IN FUEL** by using the most economical fuel available.
- **MOST ECONOMICAL CORE BINDERS** for your particular casting requirements, oil or resin, can be used.

A COMPLETE RANGE OF TYPES: COLEMAN OVENS are built in a complete range of sizes and capacities for every core-baking and mold drying requirement: Tower Ovens, Horizontal Conveyor Ovens, Car-Type Ovens, Transrack Ovens, Rolling Drawer Ovens, Portable Core Ovens, Portable Mold Dryers, etc.

THE FOUNDRY EQUIPMENT COMPANY

1831 COLUMBUS ROAD — CLEVELAND 13, OHIO

MEMBER FEMA

WORLD'S OLDEST AND LARGEST FOUNDRY OVEN SPECIALISTS

Profits Multiply...

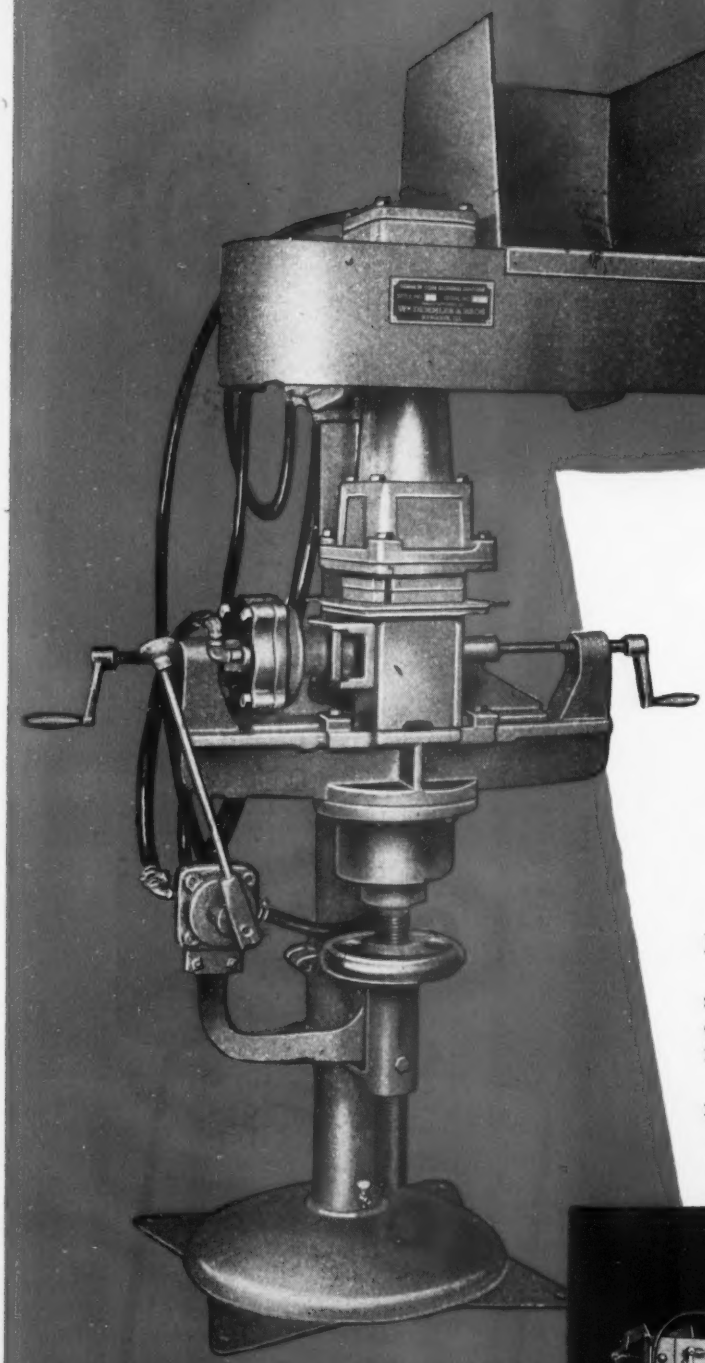
with

DEMMLER

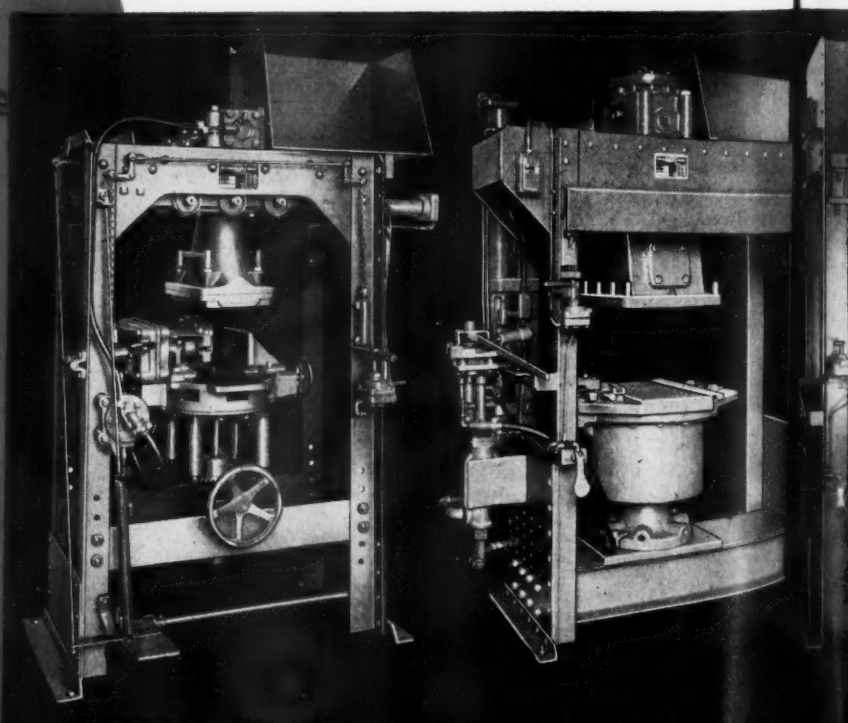
Since 1911, efficient DEMMLER Core Blowers have been making money for foundries large and small.

Their reputation for dependable — trouble-free service, coupled with their ability to produce high quality cores faster at less cost has made them a favorite everywhere!

The DEMMLER line is a complete line. There is a machine to meet every core blowing requirement.

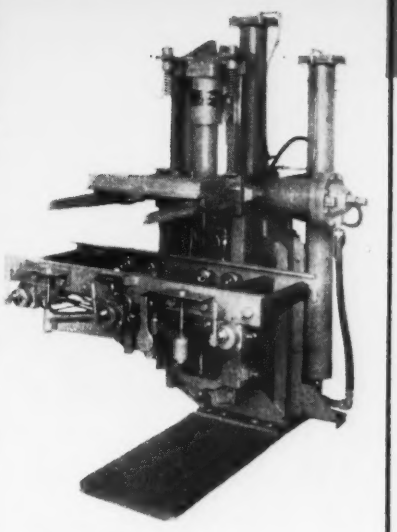


DEMMLER
NO. 55

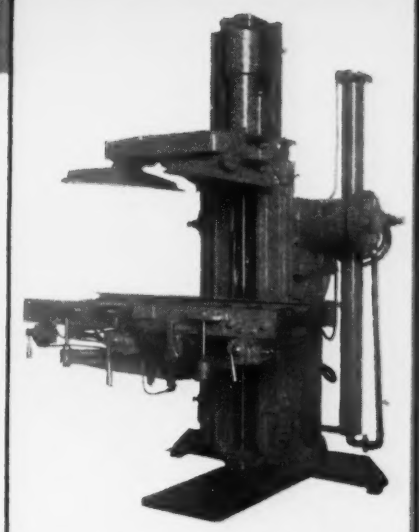


DEMMLER NO. 1

DEMMLER NO. 3E



DEMMLER NO. 2P
CORE ROLL-OVER
DRAW MACHINE



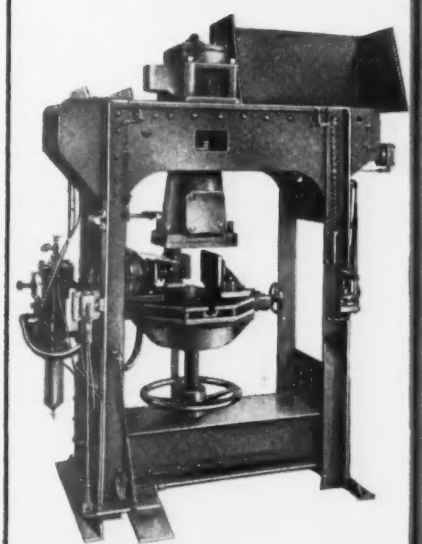
DEMMLER NO. 5P
CORE ROLL-OVER
DRAW MACHINE

Core Blowers

Each machine features both horizontal and vertical adjustments for quick, easy job changes.

Why not join the thousands who depend upon DEMMLER Core Blowers to assure them greater profits through an efficiency that sets the standards for the industry?

Descriptive literature on any of the machines illustrated will be sent on request. Write for yours TODAY!

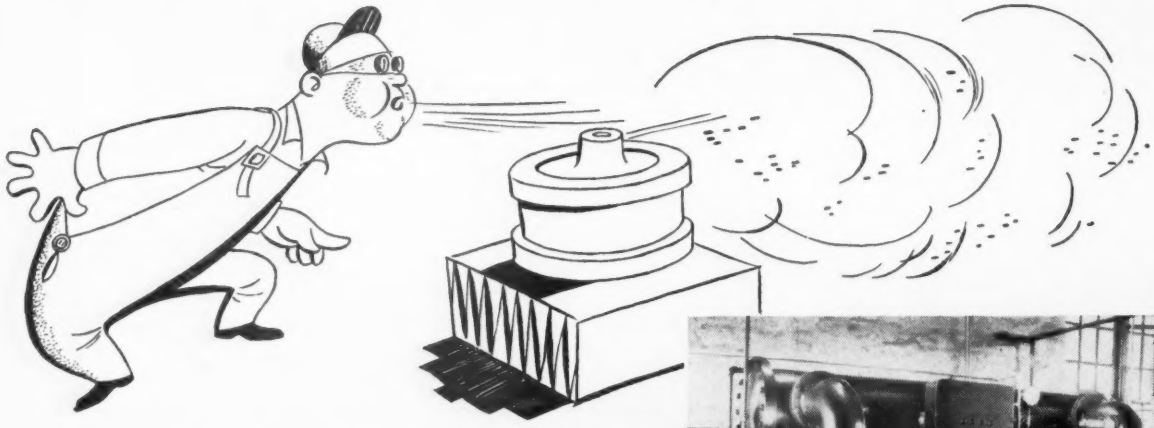


DEMMLER NO. 2

DEMMLER NO. 4E

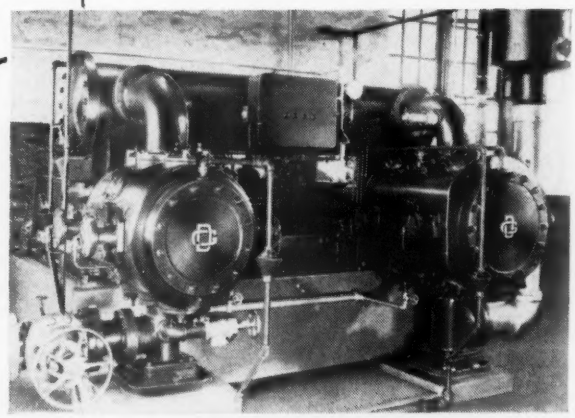
Wm. DEMMLER & Bros
Kewanee, Illinois

You don't have to skimp on compressed air!

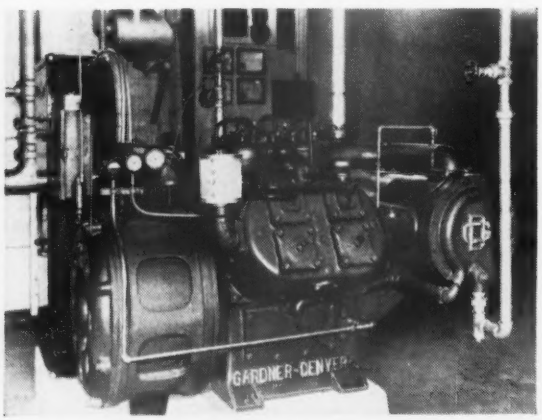


An ample supply of compressed air arms you with many opportunities to speed foundry production—conserve man-hours—hold costs in line. Especially when it's the lower-cost-per-cubic-foot air from a Gardner-Denver Compressor.

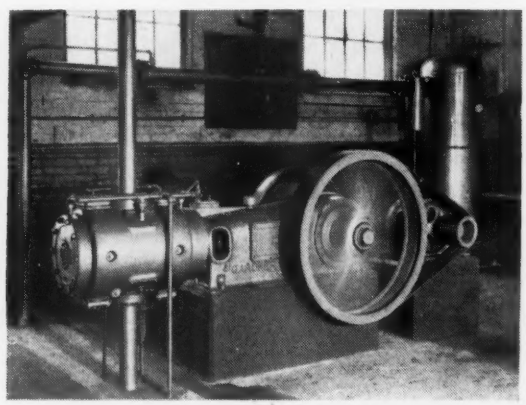
Backed by more than 90 years of quality manufacturing, Gardner-Denver Compressors handle constant peak loads—dependably . . . keep maintenance and operating costs so low you can use compressed air throughout your foundry—without skimping. Write us today for complete information.



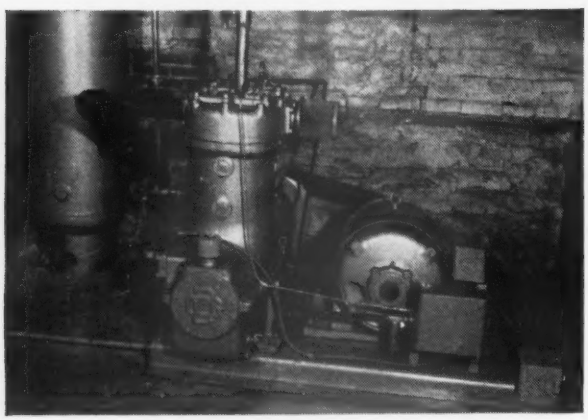
HA Two-Stage, Horizontal Compressor 593 to 1854 cu. ft. displacement per min.



WB Two-Stage, Vertical Compressor 142 to 686 cu. ft. displacement per min.



RX Single-Stage, Horizontal Compressor 89 to 1292 cu. ft. displacement per min.



AA Single-Stage, Vertical Compressor 32 to 183.6 cu. ft. displacement per min.

SINCE 1859

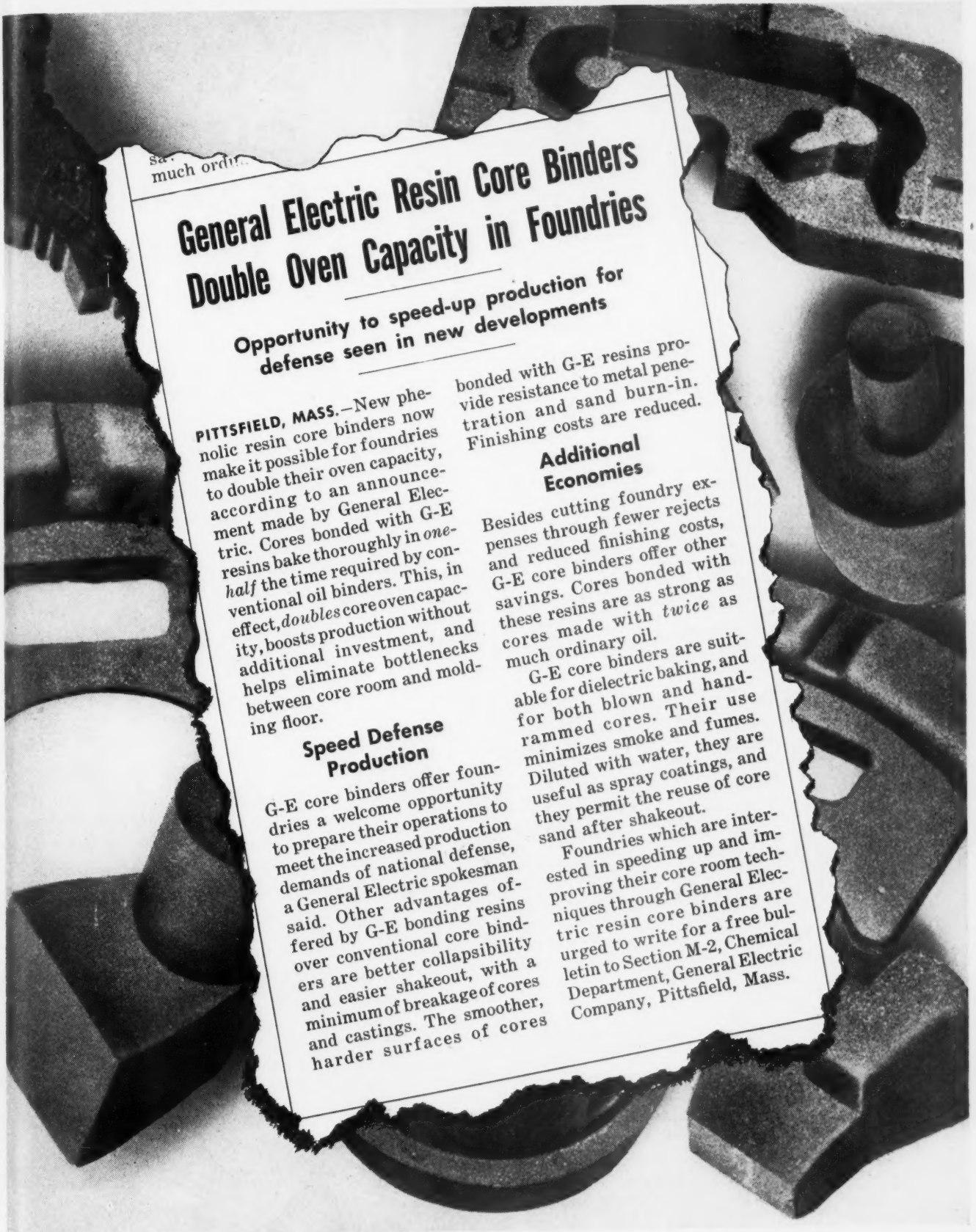
GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois, U. S. A.

In Canada:

Gardner-Denver Company (Canada), Ltd., Toronto, Ontario

THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS



much ordi...

General Electric Resin Core Binders Double Oven Capacity in Foundries

Opportunity to speed-up production for defense seen in new developments

PITTSFIELD, MASS.—New phenolic resin core binders now make it possible for foundries to double their oven capacity, according to an announcement made by General Electric. Cores bonded with G-E resins bake thoroughly in *one-half* the time required by conventional oil binders. This, in effect, *doubles* core oven capacity, boosts production without additional investment, and helps eliminate bottlenecks between core room and molding floor.

Speed Defense Production

G-E core binders offer foundries a welcome opportunity to prepare their operations to meet the increased production demands of national defense, a General Electric spokesman said. Other advantages offered by G-E bonding resins over conventional core binders are better collapsibility and easier shakeout, with a minimum of breakage of cores and castings. The smoother, harder surfaces of cores bonded with G-E resins provide resistance to metal penetration and sand burn-in. Finishing costs are reduced.

Additional Economies

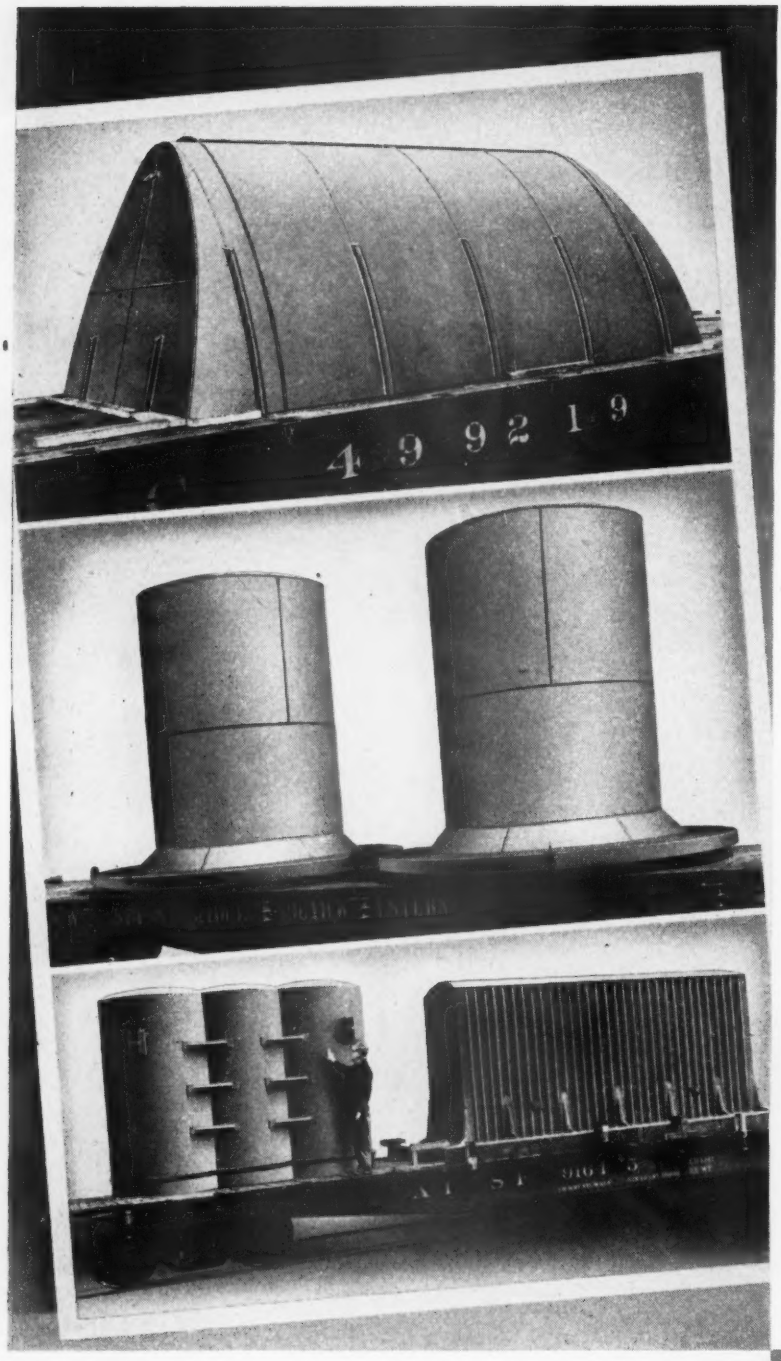
Besides cutting foundry expenses through fewer rejects and reduced finishing costs, G-E core binders offer other savings. Cores bonded with these resins are as strong as cores made with *twice* as much ordinary oil.

G-E core binders are suitable for dielectric baking, and for both blown and hand-rammed cores. Their use minimizes smoke and fumes. Diluted with water, they are useful as spray coatings, and they permit the reuse of core sand after shakeout.

Foundries which are interested in speeding up and improving their core room techniques through General Electric resin core binders are urged to write for a free bulletin to Section M-2, Chemical Department, General Electric Company, Pittsfield, Mass.

You can put your confidence in

GENERAL ELECTRIC



WOULD BIGGER COVERS CUT YOUR ANNEALING COSTS?

The operating economies of large annealing covers is obvious. Handling time is shortened when one cover replaces as many as eight. And larger covers permit larger volumes to be treated in each anneal. But installation records of large PSC covers show that other less obvious savings are effected. Made of light-gauge welded sheet alloy, they attain heat in less time; and they handle easier and faster. Being less bulky, PSC covers increase furnace capacities.

PSC "Light-Weight" Construction Makes Much Larger Covers Possible

We have made annealing covers as long as 21 feet. Because of the light-weight nature of PSC construction there is really no limit to the size of cover we can furnish. We fabricate from any alloy to meet your firing requirements. We invite you to take advantage of our 20 years experience in fabricating covers for the majority of the nation's steel mills and many leading foundries.

Weigh Up to 2/3 Less

All units in The Pressed Steel Co. complete line of heat-treating equipment, listed at right, are made of light-gauge welded sheet alloy. On the average, they weigh 2/3 less than cast equipment, resulting in outstanding savings. Yet their service life is 2 to 7 times that of cast equipment.

Light-Weight

Heat-Treating Equipment for Every Purpose

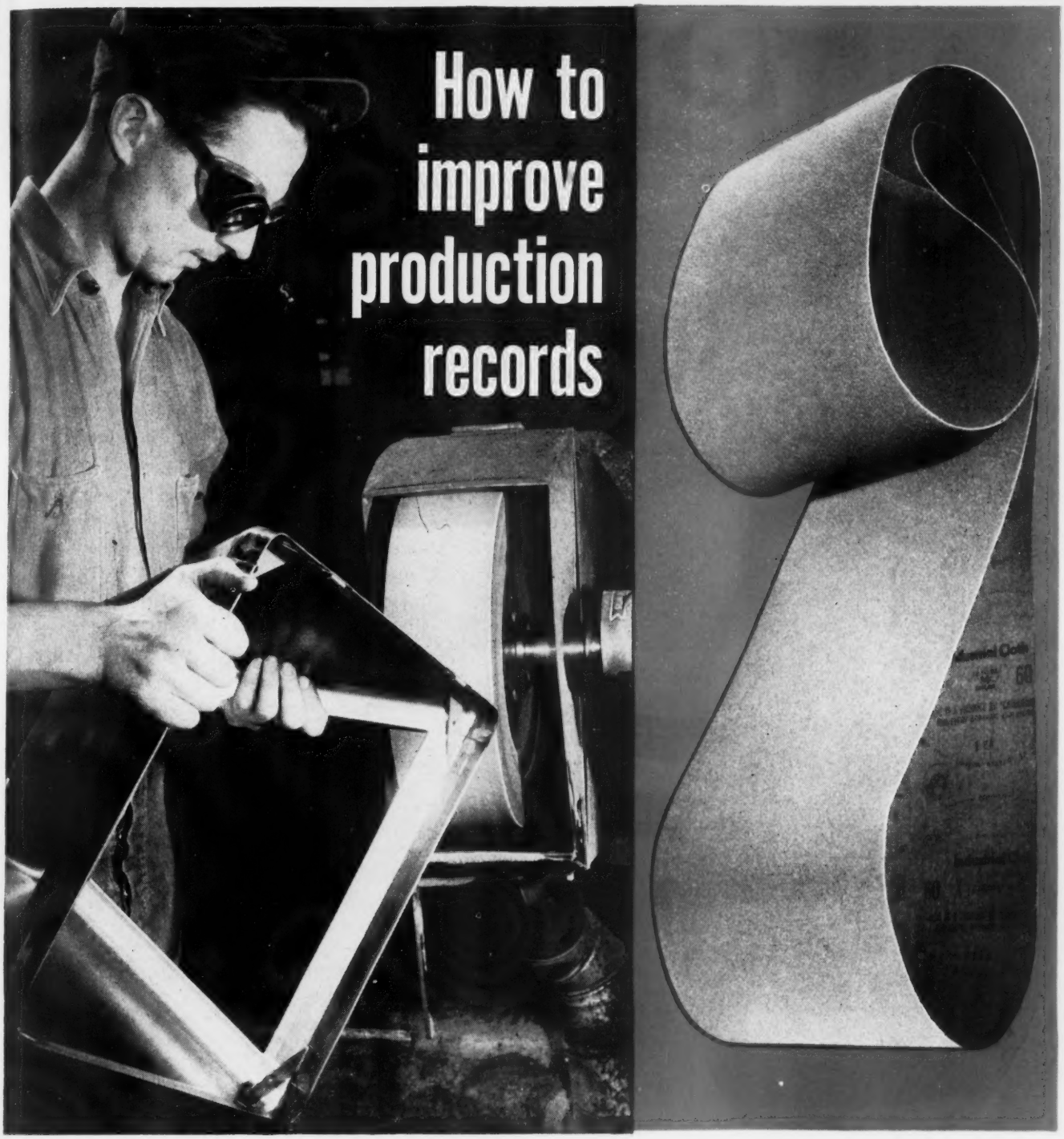
Carburizing & Annealing Boxes
Baskets - Trays - Fixtures
Muffles - Retorts - Racks
Annealing Covers and Tubes
Pickling Equipment
Tumbling Barrels - Tanks
Cyanide and Lead Pots
Thermocouple Protection Tubes
Radiant Furnace Tubes & Parts
Heat, Corrosion Resistant Tubes

THE PRESSED STEEL COMPANY

of WILKES-BARRE, PENNSYLVANIA

Industrial Equipment of Heat and Corrosion Resistant WEIGHT-SAVING *Sheet Alloys*

☆ ☆ ☆ OFFICES IN PRINCIPAL CITIES ☆ ☆ ☆



Industrial Cloth Belts by CARBORUNDUM set enviable records for improved production and economy in finishing high and low tensile strength metals. One manufacturer reports a 50% increase in the number of bronze castings ground traced directly to changing to these belts. Sharp, fast-cutting ALOXITE aluminum oxide grain and a heavy-duty backing are special features for such work. Many non-ferrous jobs require silicon carbide belts. Our representative can help analyze your particular operational requirements.

Only CARBORUNDUM
TRADE MARK

makes ALL Abrasive Products ...to give you the proper ONE

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company, Niagara Falls, N.Y.

TABOR ...headquarters for

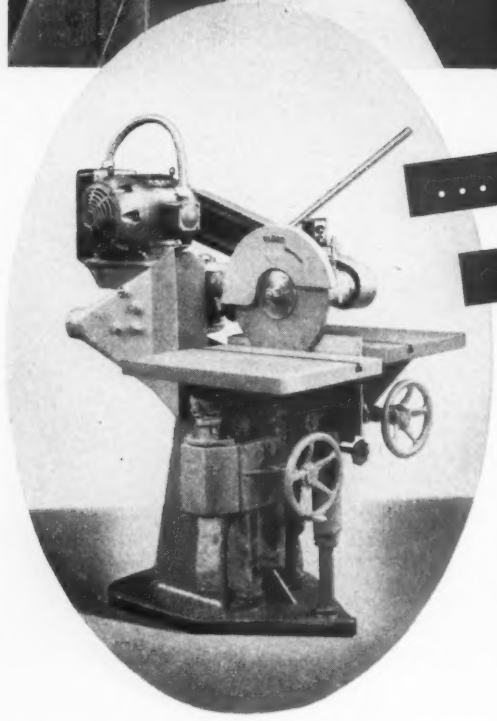
YOU'LL be placing emphasis on speed (and *more* speed) in the hurried and harried days ahead.

Speed and *Tabor-Brasive Cutoffs* are synonymous. Take the 10 H.P. machine pictured. It's cutting through 21 sq. in. of manganese bronze—and makes the cut in 70 seconds. That's mighty fast time—a good example of how top-speed production schedules are "meat" for Tabor Cutoffs.

As the table shows, these machines range from 5 to 15 H.P. They cut gates and risers from non-ferrous and ferrous castings in a matter of seconds. Clean, close cuts, too, that slash snagging and finish-grinding costs to the bone—often do away with them entirely.

And for *really tough* cutting jobs—in steel foundries, in copper cutting (gates and risers or crucible feed stock)—wherever the going's the toughest, Tabor makes a big-value 15 H.P. machine.

Equipped with today's hard-to-break, safe-to-use wheels, the Tabor-Brasive is *your* answer to more cuts at less cost, with safety. We welcome your inquiry!



. . . FOR GATES AND RISERS

SPECIFICATIONS — GATES AND RISERS CUTOFFS

Motor	Table Size (Split Type)	Wheel Diam.	Max. Height of Work Under Wheel
5 H.P. (Type D5AC)	28" x 20"	14" Max. Thickness—5/32"	4" (head does not swing to side)
5 H.P. (Type B5AC)	28" x 20"	16" Max. Thickness—3/16"	10" (with head over table)
7½ H.P. (Type B7½AC)	28" x 20"	16" Max. Thickness—3/16"	10" (with head over table)
7½ H.P. (Type C7½AC)	36" x 25"	16" Max. Thickness—3/16"	17" (with head over table) 40" (with head swung to side)
7½ H.P. (Type C7½AF)	36" x 25"	16" Max. Thickness—3/16"	20" (with head over table) 46" (with head swung to side)
10 H.P. (Type C10AF)	36" x 25"	16" Max. Thickness—3/16"	20" (with head over table) 46" (with head swung to side)
15 H.P. (Two-speed)	41" x 30"	20" Max. Thickness—3/16"	18" (with head over table) 44" (with head swung to side)
All motors fully enclosed, fan-cooled, ball bearing			

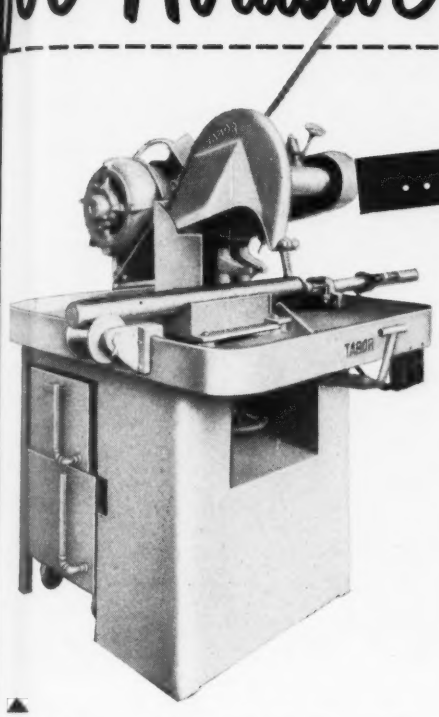
REPRESENTATIVES

Snyder Foundry Supply Company, Los Angeles, Calif.; The Pacific Graphite Company, Inc., 40th & Linden Sts., Oakland 8, Calif.; Carl F. Miller & Company, Seattle, Washington; Harry H. Reich, Trussville, Ala.

they're cut out . . .

...for Abrasive Cutoff Machines!

. . . FOR BAR STOCK AND SHAPES



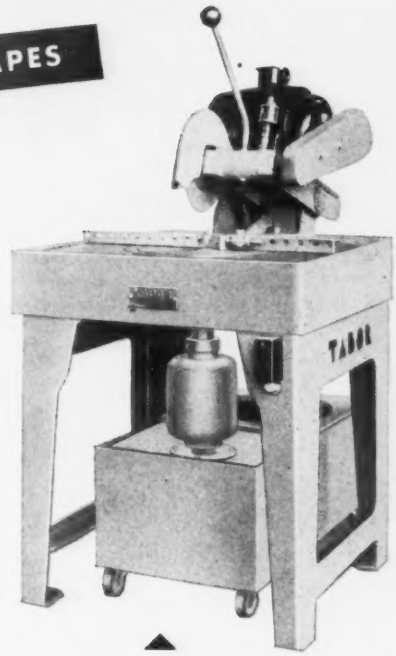
Type D10FWP. 10 H.P., wet cut, right angle; wheels up to 16" dia. (up to 3/16" thick); 10,000 FPM wheel speed; wheel and coolant push-button controlled; cuts 2½" solids, 3" x ⅜" angles, 4½" tubing, ¾" x 3" flats.

THIS page is of special importance to management of captive shops and foundries with their own machine shop operation.

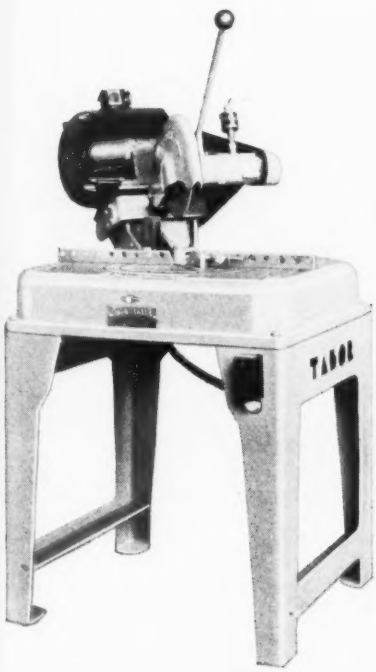
Pictured and described are the newest additions to the Tabor line—abrasive cutoff machines for bar stock and shapes. There's a size and type to meet every need.

The "heart" of these machines—the spindle—bears the same stamp of excellence for which our foundry units are famous. Timken Bearing-mounted, specially constructed, the spindle assures cool running and reduces end-play adjustment to an all-time low.

Get full details on these tough, precise, "production-minded" units. We have new bulletins. They're yours for the asking.

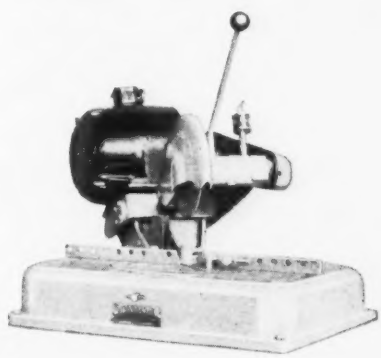


Type G3AEW. 3 H.P., wet cut, right angle to 45° bevel; 12" wheel (thickness to 5/32"); 10,000 FPM wheel speed; 3,200 rpm spindle speed; cuts ¾" solids or equiv., 2" tubing, 2" x 6" light sheet formed sections, ½" x 1" flats.



Type G3AE. 3 H.P., dry cut, right angle to 45° bevel; 12" wheel; 15,000 FPM wheel speed; 4,800 rpm spindle speed; under-machine spark and refuse pan is provided. Cutting capacities same as for Type G3AEW.

Type G3AE (Bench Mount Model). 3 H.P., dry cut, right angle to 45° bevel; cutting capacities same as for Type G3AEW.



The TABOR Manufacturing Co.

SINCE 1884 MANUFACTURERS OF FOUNDRY MOLDING MACHINES

6225 TACONY STREET • PHILADELPHIA 35, PENNA.

Export Department, 765 Drexel Bldg., Phila. 6, Pa.

. . . to cutoff!

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

FIRST AID For Foundries —with these jobs!

Are you still trying to handle and move sand by slow, costly and laborious methods when power can do the job faster and cheaper?

Hundreds of PAYLOADERS in foundries have thoroughly proven their ability to save time, money and manpower and boost production. Each one of these specially built tractor-shovels can release several men for more productive, more profitable work . . . can pay for itself in a few months by the savings and the increased production gained.

The 12 cu. ft. Model HA shown is the smallest of the complete PAYLOADER line. It unloads box cars, scoops up a ton of sand, scrap, coke, etc., at a time, carries at speeds up to 10 miles per hour, indoors or outdoors, through narrow aisles, up ramps . . . spreads and windrows . . . dumps over edges up to 5½ feet high.

Get first aid for your material-handling problems — with PAYLOADERS! They're sold and *serviced* by a world-wide Distributor organization. The Frank G. Hough Co., 703 Sunnyside Ave., Libertyville, Illinois.

- Unload box cars.
- Carry sand, coke, scrap, limestone, etc., to storage.
- Transport and distribute sand to molding stations.
- Remove used sand from floors.
- Windrow sand for the cutter.
- Charge mullers, tumbling barrels.
- Feed conveyors, elevators, hoppers, mixers.
- Clean up gangways, aisles, and other areas.
- Handle scrap, small castings, slag.
- Lift—haul—push—pull.

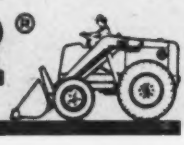
Ideas are Dollars—

and "Industrial Handling" magazine is full of profitable ideas developed by PAYLOADER users. A request on your letterhead puts you on the FREE subscription list.

SAY "HUFF"

PAYLOADER®

THE FRANK G. HOUGH CO. · Since 1920



General Purpose

"FOUNDROMATIC" SHAKEOUTS

New SIMPLIFIED SHAKEOUT

Ideal for Small Operations

THE NEW GENERAL PURPOSE *Foundromatic* shakeout now brings to the smaller foundry the proven basic advantages of the shakeout . . . higher production per square foot of foundry and per man, improved working conditions, and low maintenance. And this *Foundromatic* shakeout design, exclusively Allis-Chalmers, is field-proven!

The General Purpose shakeout is **versatile in installation!** It either can be installed permanently *or* it can be mounted on a portable base. It can be installed with the deck horizontal for general shakeout duty or with a slope so that castings or flasks will discharge.

The General Purpose shakeout is **versatile in application!** *Foundromatic* shakeouts are suitable for steel, gray iron and non-ferrous foundry mold shakeout *and casting core knockout applications.*

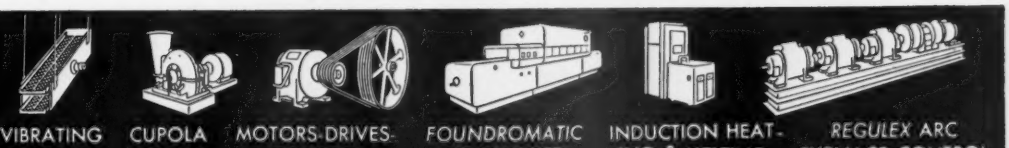
The General Purpose shakeout is **designed for long service!** Weight of body and load is supported and isolated from the foundation by rubber mountings for elimination of virtually all vibration transmission. Centrifugal force alone produces the vibration in a *two bearing* mechanism. The vibrating force is produced by a shaft machined eccentrically between the bearings eliminating balance wheels and requiring only *one* dust seal. And the drive is true running with the motor isolated from the operating amplitude.

The General Purpose *Foundromatic* shakeout is being manufactured in five sizes, ranging in capacity from 2000 to 5000 lb. Call your nearby A-C sales office for information, or write to Allis-Chalmers, Milwaukee 1, Wis. for Bulletin 07B7532. A-3265

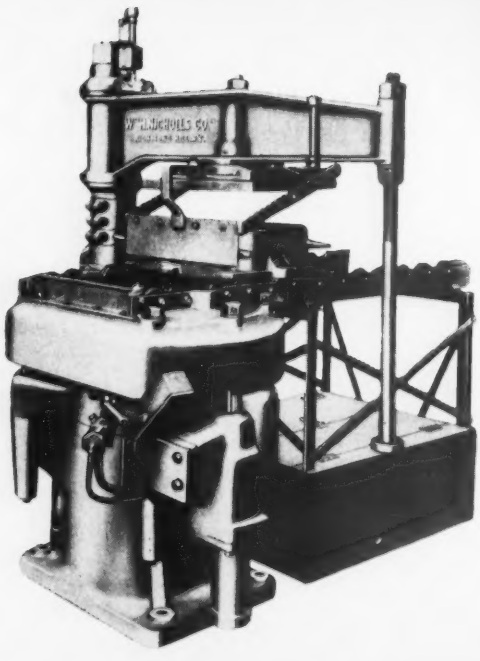
ALLIS-CHALMERS

Foundromatic and Regulex are Allis-Chalmers trademarks.

Foundry Equipment for Bigger Output-Better Working Conditions!



VIBRATING SCREENS | CUPOLA BLOWERS | MOTORS-DRIVES-CONTROL | *FOUNDROMATIC* CORE DRYER | INDUCTION HEATING & MELTING | *REGULEX* ARC FURNACE CONTROL



IMPROVED HEAVY DUTY MOLDING MACHINES

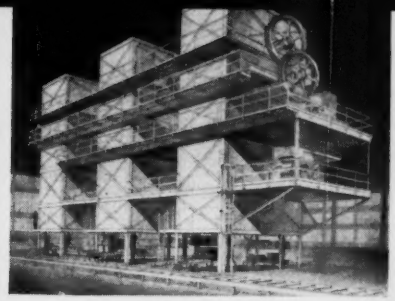
NICHOLLS Molding Machines are packed with POWER. They have the strength and ruggedness to withstand the pressure of continuous operation and consistently turn out the maximum number of good molds. Nicholls Molding Machines have the POWER to knock your production costs "for a loop" and give you the best possible results at the lowest possible costs. Nicholls has a complete line of stationary and portable types for the production of light, medium and heavy castings. Can be furnished with electric controls for push button operation.

Wm. H. NICHOLLS Co., Inc.
RICHMOND HILL 18, LONG ISLAND, NEW YORK

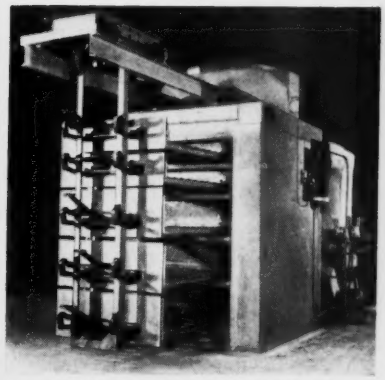
ESTABLISHED 1910

Foreign Manufacturers and Selling Agents—For Continental Europe and Great Britain—George Fischer, Ltd., Schaffhausen, Switzerland

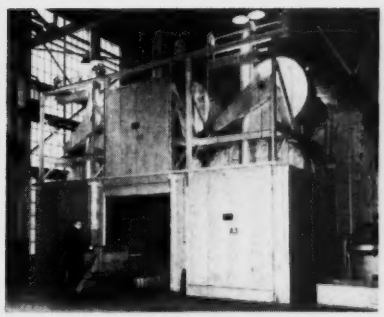
NICHOLLS



VERTICAL CORE OVENS
at General Steel Castings Co.



ROLLING DRAWER CORE OVEN
at Aluminum Co. of America



RACK TYPE CORE OVENS
at Aluminum Co. of America

CARL-MAYER

CORE AND MOLD OVENS

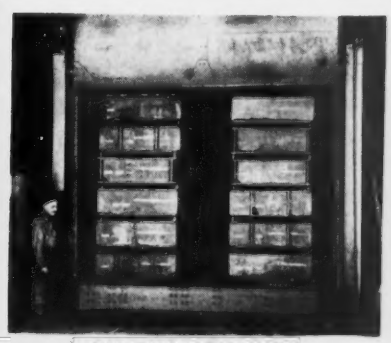
Outstanding Engineering

ALSO OTHER TYPES OF INDUSTRIAL OVENS, AND FURNACES.

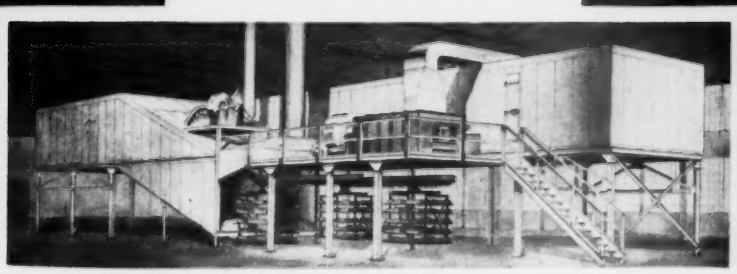
OUR CUSTOMERS

Important concerns like these:

Aluminum Co. of America
American Brake Shoe Co.
American Radiator Co.
Blaw-Knox Co.
Brown Industries
Buick Motor Div. of General Motors Corp.
Bucyrus-Erie Co.
Cadillac Motor Div. of General Motors Corp.
Columbia Steel Corp. (U.S. Steel Corp.)
Crucible Steel Castings Co.
Dunkirk Radiator Co.
Eclipse Aviation Division of Bendix Aviation Corp.
Electric Autolite Co.
Ford Motor Co.
Fremont Foundry Co.
General Electric Co.
General Motors Corp. and Subsidiaries.
Gilbert & Barker Co.
General Steel Castings Co.
Golden Foundry Co., Inc.
Henry Kaiser Corp.
W. O. Larson Foundry Co.
Mesta Machine Co.
F. E. Meyers & Bro. Co.
Oil Well Supply Co. (U. S. Steel Corp.)
Packard Motor Car Co.
H. B. Salter Co.
Shenango Penn Mold Co.
Standard Foundry Co.
Union Brass & Metal Mfg. Co.
Union Steel Castings Co.
West Steel Castings Co.
A. C. Williams Co.
Whiten Machine Works
Whiting Corp.



CAR TYPE MOLD OVEN
at Oil Well Supply Co.



HORIZONTAL MONORAIL CORE OVEN at Eclipse Aviation Co.

Write for Bulletins No. 141 and 350

THE CARL-MAYER CORPORATION

3030 Euclid Avenue • Cleveland, Ohio

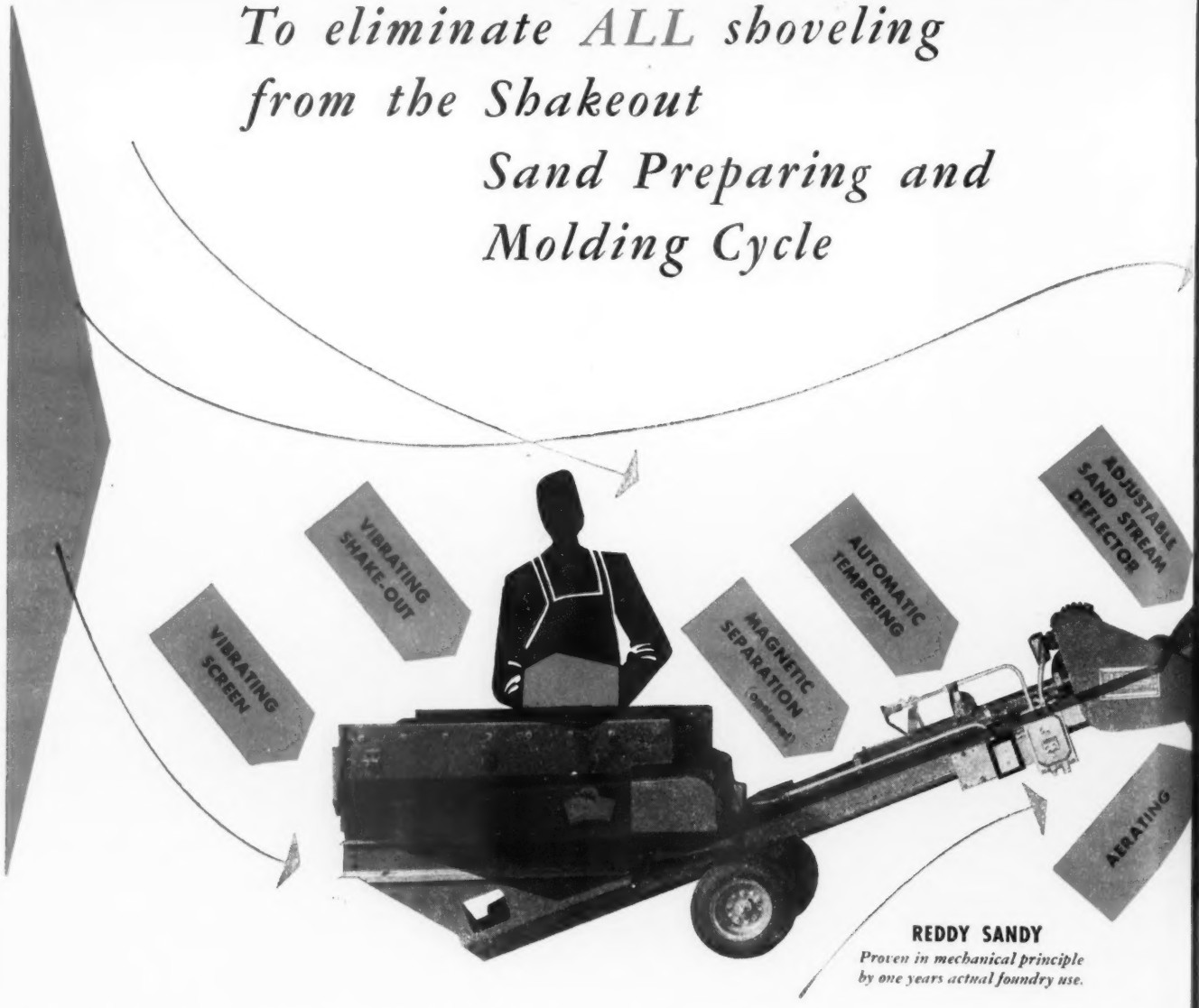
BACKED BY REPUTATION AND OVER 30 YEARS' EXPERIENCE

Now! the NEW REDDY

A PORTABLE SHAKEOUT

Combines with HA

To eliminate ALL shoveling from the Shakeout Sand Preparing and Molding Cycle



REDDY SANDY
Proven in mechanical principle by one years actual foundry use.

At last, the hard work normally connected with shake-out and sand-conditioning operations, has been eliminated. Now, all you have to do is dump the mold on the vibrating deck of the new Reddy Sandy and the rest of the job is done for you. The top or shake-out deck separates the sand from castings and cores. The vibrating screen under the shake-out deck of the Reddy Sandy screens the sand and removes tramp iron and core butts without shoveling of any type. A magnetic separator (optional) removes smaller metal particles and an automatic tempering device uniformly adds water. As the sand is discharged from the Reddy Sandy, a built-in Aerator blends in the water, fluffs the sand and cools it.

By using the Reddy Sandy with the time-tested Handy Sandy, sand never has to touch the floor. Reddy Sandy delivers the prepared sand onto the wing boards of the Handy Sandy where it is raised by means of a bucket elevator into an overhead storage hopper conveniently located for the molder. As the sand enters the hopper, it is given an additional aeration, by an Aerator built into the elevator. There is no shoveling anywhere from the time the flask is dumped until the molder opens the hopper to allow the sand to drop into the flask.

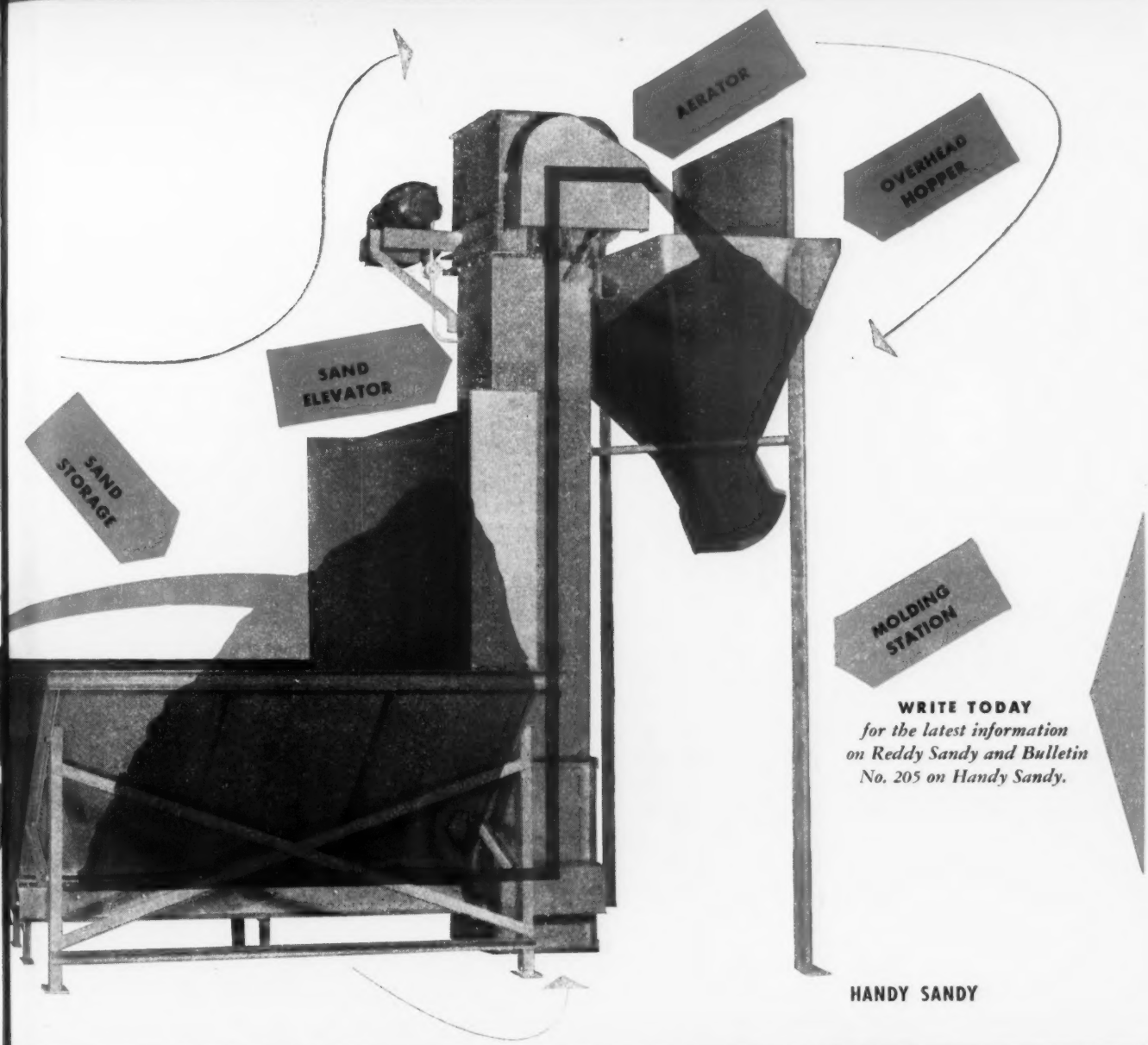
The shake-out deck of the Reddy Sandy is a convenient height so molds can be dumped with little effort. Equipped with pneumatic-tired wheels, the Reddy Sandy is easily moved from floor to floor.

Send now for full details and prices.

DY SANDY

AND SAND PREPARING UNIT

it HANDY SANDY®



WRITE TODAY
for the latest information on Reddy Sandy and Bulletin No. 205 on Handy Sandy.

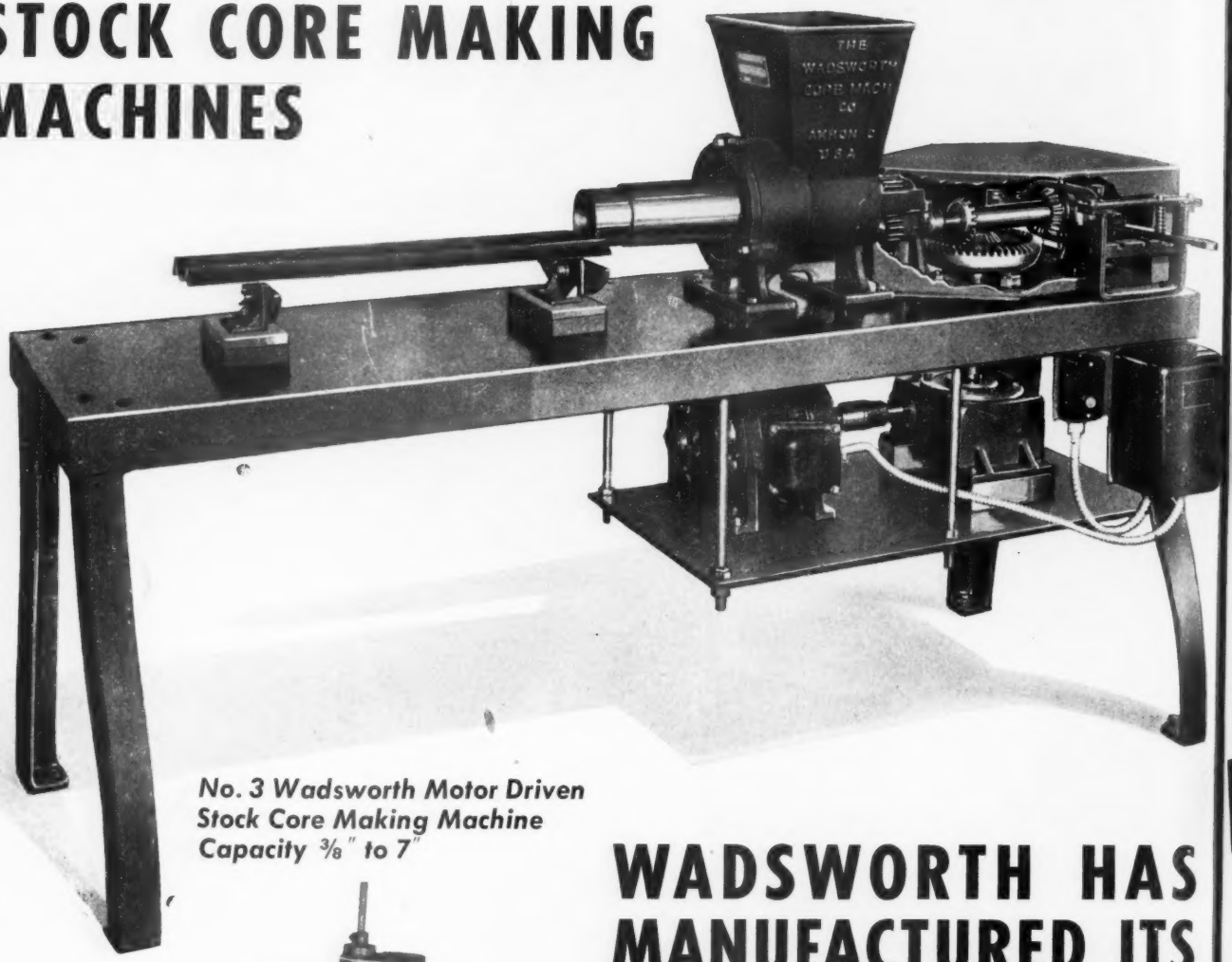
HANDY SANDY

NEWAYGO ENGINEERING COMPANY

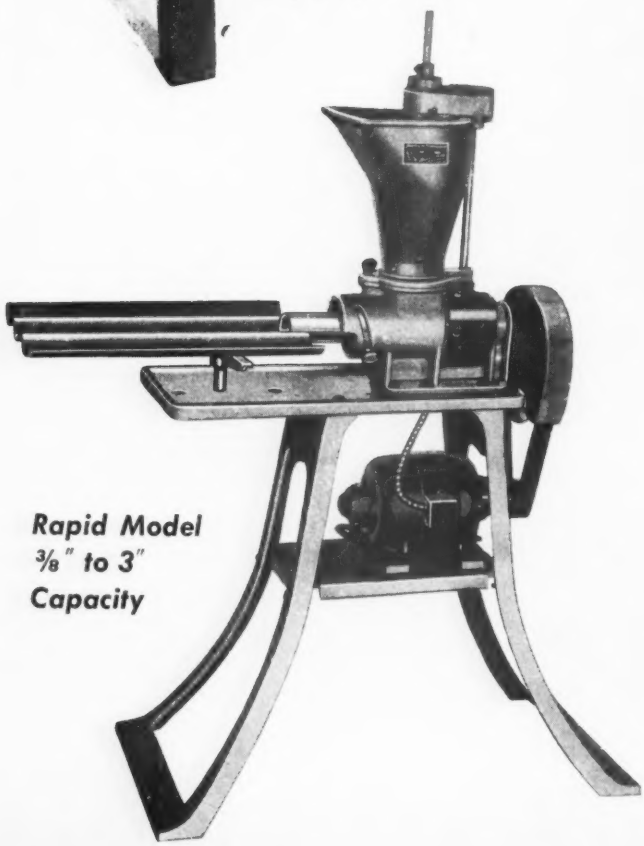
NEWAYGO, MICHIGAN

WADSWORTH

STOCK CORE MAKING MACHINES



No. 3 Wadsworth Motor Driven Stock Core Making Machine Capacity 3/8" to 7"



Rapid Model 3/8" to 3" Capacity

WADSWORTH HAS MANUFACTURED ITS FAMOUS CORE MAKING MACHINES FOR OVER 45 YEARS

Hand driven, Belt driven and Motor driven models to make stock cores 3/8" to 7" in Round, Square and Irregular Shapes.

WADSWORTH EQUIPMENT CO.

555 La Follette St.
AKRON 11, OHIO

This 85" hollow-section ring is produced by The French Oil Mill Machinery Company, Piqua, Ohio. It weighs 6500 lbs. and meets tensile strength requirements of 40,000 lbs.

FOR HOLLOW-SECTION CASTINGS...

CHATEAUGAY TOPS THEM ALL!

Consider, for example, this giant ring—a component of the desolventizer toaster used in processing soya beans into cattle feed. Hollow passages between the ¾" thick dual wall sections form a pressurized steam chamber. Because of this, each finished casting must undergo a 300 psi water pressure test before passing code inspection.

Here are the reasons why CHATEAUGAY, Republic's *exclusive* premium pig iron, is used in this application:

1. **CHATEAUGAY is an exceptionally fluid iron . . . cools evenly . . . fills adjoining light and heavy sections completely.**
2. **CHATEAUGAY shrinks evenly throughout every casting . . . produces an unusually fine and uniform grain structure.**
3. **CHATEAUGAY castings machine readily.**

Whether or not you use CHATEAUGAY Pig Iron, a Republic Pig Iron Metallurgist will be glad to help you get top production from your present facilities. Just let us know when you would like to see him.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

Republic PIG IRON

"CHATEAUGAY"	"REPUBLIC"	"PIONEER"
Low-Phosphorus, Copper-Free	(Northern) Foundry, Basic and Malleable	(Southern) Foundry and Basic

REPUBLIC STEEL

CENTRAL DEWATERING SYSTEMS

SAVE TROUBLE-SAVE MONEY

Complete Foundry Ventilation Coverage with Maximum Efficiency—Minimum Cost

Central dewatering of collected material is an outstanding feature of Schneible Multi-Wash systems. No matter how many Multi-Wash collectors are used only one dewatering unit is needed. This allows flexibility by providing for future expansion at lowest cost.

A recirculating water system carries the solid material from the collector in sludge form to the dewatering tank where a series of baffles and gravity settles out all collected matter and returns clear, useable water to the collectors.

This feature eliminates the emptying of individual collectors and transporting of collected material through work areas by centralizing this operation at the most convenient place for removal by clam-shell bucket to truck or railroad car.

Many types of dewatering tanks are available to suit your requirements. Check with the local Schneible representative or write direct for complete information.

FOUNDRY EQUIPMENT MEMBER FEMA MANUFACTURERS ASSOCIATION INC.

CLAUDE B. SCHNEIBLE COMPANY

P. O. BOX 502, ROOSEVELT ANNEX
DETROIT 32, MICHIGAN

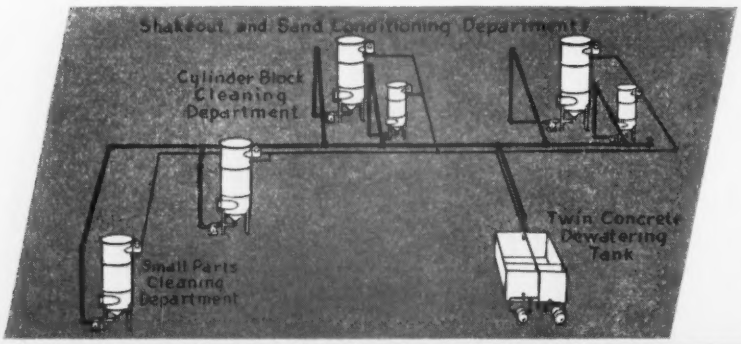

Shakeout and Sand Conditioning Department
Cylinder Block Cleaning Department
Twin Concrete Dewatering Tank
Small Parts Cleaning Department

Diagram shows a typical Schneible Multi-Wash system with Central Dewatering tank as applied to an automotive foundry. Many Multi-Wash units may be added to this type of layout without additional expense for Dewatering facilities.

MULTI-WASH COLLECTORS available from 1000 to 36,000 c.f.m. for all dust, fume and smoke control applications.

SCHNEIBLE

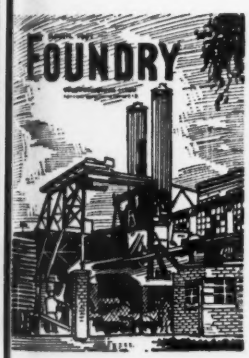
FOUNDRY News Report

Mar. 27, 1951

DEFENSE SESSIONS: Two special luncheon meetings concerned with national defense matters affecting foundries have been arranged for the American Foundrymen's Society convention in Buffalo, Apr. 24-25. A foundry equipment and supplies industry luncheon will be held Tuesday, Apr. 24, sponsored by the Foundry Equipment Manufacturers Association and the Foundry Facings Manufacturers Association. Speakers will be A. J. Grindle, director, Foundry Equipment & Supplies Section, Machinery Division, NPA, Washington, and Thomas Kaveny Jr., Herman Pneumatic Machine Co., Pittsburgh, industry consultant to NPA. Subjects relating to defense orders and materials procurement will be discussed at a Wednesday luncheon sponsored by the AFS. Speakers will include A. J. McDonald, chief, Castings Section, and John A. Clausen, chief, Pig Iron Section, Iron & Steel Division, NPA, and a representative of NPA nonferrous divisions.

PROCUREMENT ACCELERATED: Contract letting for defense procurement is speeding up. Military department obligations averaged $2 billion monthly for the last six months of 1950; they were $4.4 billion in January, and recently have been around $5 billion monthly. The total through February was divided $8 billion for the Army, $4 for the Navy and $7.7 for the Air Force. Contracts for hard goods represented $16.3 billion. For fiscal 1951 Congress made $45.7 billion available to the Armed Forces. Major programs covered by contracts already placed involve combat vehicles and aircraft. Award of these contracts is much further along than in other types of procurement.

TIGHTER SITUATION AHEAD: So far the civilian economy has been affected relatively little by the defense program. The impact will be felt increasingly in coming months as limitation orders applying to use of certain materials take effect. The next 60 days should tell whether or not further cuts in civilian goods production will be necessary to assure a sufficient material supply for defense purposes. A decision also has yet to be made on exactly what type of controlled materials plan is to be instituted, probably around midyear.



THE COVER: Charging equipment and twin cupolas at the Belle City Malleable Iron Co., Racine, Wis.
See page 10

CIVILIAN CUTS: Gray iron, malleable iron and steel castings come under NPA Order M-47, which limits use of iron and steel in making various civilian products. These items include major household appliances and fixtures, automobiles, novelties and miscellaneous products. During the second quarter the use of iron and steel products in manufacturing the specified civilian goods is limited to 80 per cent by weight of the average quarterly amount used by each consumer during the six months ended June 30, 1950.

CONTROLS NOT PERMANENT: General belief that, even in the absence of all-out war, a prolonged state of emergency will exist, does not necessarily mean an indefinite continuation of the material controls now beginning to affect most manufacturers. Washington officials point out that the huge expansion under way in our industrial capacity—notably in vital metals—ultimately should permit the support of both an unrestricted civilian economy and defense needs. But it may take two years to bring this about.

PRICE DEVELOPMENTS: Of chief interest in price controls is the new regulation scheduled to take effect early in April on manufactured goods, including castings. This regulation replaces the general price freeze applied in January. It permits addition of increased labor and material costs since the second quarter of last year in arriving at new ceilings, but sets a limit on the extent to which these prices may exceed maximum quotations prevailing either in the second quarter of 1950 or under the OPS general price regulation. Advisory task group of the four casting divisions met simltaneously with OPS this week to discuss the new regulation. Unlike OPA days, there probably will not be separate regulations for the different branches.

COKE OUTLOOK: Chances of any appreciable increase in supplies of foundry coke are poor—either for the near future or the long term. New oven construction planned by steel producers will not affect the situation because the

coke to be made will be required by the blast furnace capacity being added simultaneously. One adverse factor in the immediate outlook is the recent closing down of the Erie, Pa., ovens for repairs—possibly a ten-month job. Introduction of natural gas in the East also is expected to curtail coke production there by causing some manufactured gas plants to be shut down.

COKE PRICES: Higher wages to coal miners may be reflected in coke prices. OPS has given coke producers permission to adjust their ceiling prices to cover the increased cost of coal resulting from the wage hike. The operating margin after the boost must be held at the same figure prevailing during 1950. This regulation is a temporary measure, expiring June 30; meanwhile OPS expects to prepare a permanent regulation.

AGENCY PERSONNEL: Three more foundrymen have joined the OPS Metals Division as consultants on pricing matters affecting castings. They are: Ralph N. Cole, president, Canton Malleable Iron Co., Canton, O., on malleable; Ralph L. Lee, secretary-treasurer, Grede Foundries Inc., Milwaukee, on gray iron castings, and Lawrence C. Mertz, vice president, Unitcast Corp., Toledo, on steel castings. Francis J. Buckley, Economy Engineering & Machine Works, Chester, Pa., has been appointed assistant to A. J. McDonald, chief, Castings Section, Iron and Steel Division, NPA. Lloyd A. Mapes, recently with Reynolds Metals Co., is the new head of the Castings Section, Light Metals Division, NPA. Donald MacBrien, Philadelphia Coke Co., has been loaned to the Department of the Interior as assistant director of the Coke Division, Defense Solid Fuels Administration. A. J. Grindle, who, as previously reported, heads the Foundry Equipment and Supplies Section in the Machinery Division, is located in Room 2135, Tempo T, phone number STerling 5200, extension 4805.

TANK CASTINGS: Representatives from each Ordnance district attended the annual meeting of the Steel Founders' Society of America in Chicago, Mar. 19, to emphasize a pressing need for steel castings for tanks, especially cast parts weighing up to 300 pounds. Trend in tank construction is toward maximum application of cast armor, providing source of supply can be secured.

PRICES OF FOUNDRY METALS AND COKE

(As of Mar. 26, 1951)

FOUNDRY COKE

(Per net ton, f.o.b. ovens)

BEEHIVE	
Connellsville	$17.00-18.00
New River	19.50
Wise County	15.95
OVEN	
Birmingham	$20.30
Chicago	21.00
Detroit	24.00
Erie, Pa.	23.50
Everett, Mass.	24.80
Indianapolis	22.75
Kearney, N. J.	22.75
Milwaukee	23.75
Painesville, O.	24.00
Philadelphia	22.70
Pittsburgh	23.00
Portsmouth, O.	21.50
St. Louis	24.25
Swedeland, Pa.	22.00
Terre Haute, Ind.	22.50

PIG IRON

(Per gross ton, f.o.b. furnace)

	No. 2 Foundry	Malleable
Bethlehem, Pa.	$54.50	$55.00
Birmingham	48.88	....
Buffalo	52.50	53.00
Chicago	52.50	52.50
Cleveland	52.50	52.50
Everett, Mass.	53.25	53.75
Fontana, Calif.	58.50	....
Geneva, Utah	52.50	....
Granite City, Ill.	54.40	54.90
Lone Star, Tex.	48.50	48.50
Pittsburgh	52.50	52.50
Steelton, Pa	54.50	55.00
Swedeland, Pa.	56.50	57.00
Toledo, O.	52.50	52.50
Troy, N. Y.	54.50	55.00
Youngstown, O.	52.50	52.50

NONFERROUS INGOTS

BRASS AND BRONZE: 85-5-5-5—29.00c; 88-10-2—43.25c; 80-10-10—35.00c; No. 1 yellow—25.00c. **ALUMINUM:** 99 per cent plus, primary ingots 19.00c. Secondary No. 12 alloy 29.50-30.25c. **MAGNESIUM:** 99.8 per cent standard ingots 24.50c, f.o.b. Freeport, Tex. **COPPER:** Electrolytic 24.50c, Connecticut valley; Lake 24.61½c, delivered. **ZINC:** High grade 18.60c, delivered.

IRON AND STEEL SCRAP

(Ceiling prices per gross ton as established by the Office of Price Stabilization)

	*No. 1 Heavy Melting Steel	**Steel, 2 ft & less	Punchings, Plate Scrap	Cast Iron Briquets
Birmingham	$39.00	$41.00	$41.50	$39.00
Buffalo	43.00	45.00	45.50	43.00
Chicago	42.50	44.50	45.00	42.50
Cincinnati	43.00	45.00	45.50	43.00
Cleveland	43.00	45.00	45.50	43.00
Detroit	40.00	42.00	42.50	40.00
Eastern Pa.	42.50	44.50	45.00	42.50
Los Angeles	35.00	37.00	37.50	35.00
Pittsburgh	44.00	46.00	46.50	44.00
San Francisco	35.00	37.00	37.50	35.00
St. Louis	41.00	43.00	43.50	41.00
Seattle	35.00	37.00	37.50	35.00

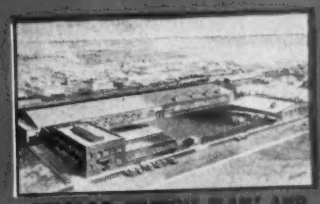
Above delivered prices are ceiling levels at basing points indicated. * Applies to dealer and industrial scrap; railroad heavy melting is $2 higher. ** Foundry steel 1 ft and under is $2 higher.

CAST IRON SCRAP

No. 1 cupola cast	$49.00
Heavy breakable cast	45.00
Burnt cast iron	41.00
Cast iron brake shoes	41.00
Stove plate	46.00
Clean auto cast	52.00
Unstripped motor blocks	43.00
Iron wheels, No. 1	47.00
Malleable	55.00
Drop broken machinery cast	52.00

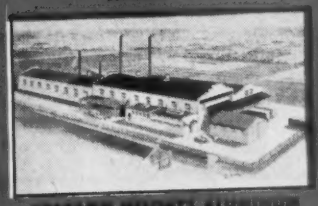
Above ceiling prices, per gross ton, are f.o.b. shipping point. Add transportation charges to obtain delivered prices at any foundry.

How Christiansen Corporation has grown to serve you



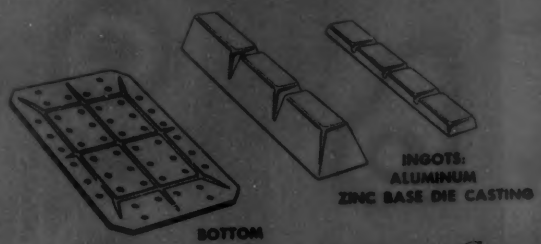
CHICAGO, ILLINOIS PLANT AND WAREHOUSE

CHICAGO, ILLINOIS ZINC SMELTER



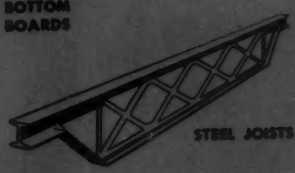
CHICAGO HEIGHTS ALUMINUM SMELTER

MAGNESIUM & STEEL FABRICATING PLANT



INGOTS: ALUMINUM ZINC BASE DIE CASTING

BOTTOM BOARDS



STEEL JOISTS

TRANSMISSION POLES

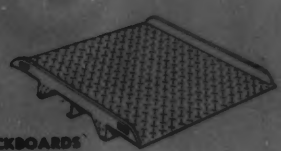
MARITIME GANGPLANKS

CASTINGS: ALUMINUM PERMANENT MOLD

HAND TRUCKS

GRAIN SHOVELS

BARREL SKIDS



DOCKBOARDS

Christiansen Corporation, and its subsidiary and affiliated companies, has for over a quarter of a century been active in development and progress of structural steel uses . . . aluminum and its general applications . . . and in magnesium production and fabrication from its inception in this country.

Since start of manufacture in 1914, its patented line of expanded steel poles, joists and other light structural steel building products has gained an international reputation. This expansion method of manufacture affords the lightest structure possible for equal strength.

Further product diversification, in line with the growing importance of "the light metal age", added production of non-ferrous alloy metals in ingot form as well as general magnesium fabrication and aluminum casting manufacture. Specific products for the foundry industry are Aluminum Alloy Ingot, Zinc Base Die Casting Alloys, and Magnesium Bottom Boards. Magnesium fabrication includes manufacture of such products as Dockboards, Maritime Gangplanks, Hand Trucks, Tote Boxes, Barrel Skids, and Grain Shovels as well as general fabricating work in the experimental, industrial, and military fields. Manufacture is conducted by use of all the modern equipment for complete fabrication work including the processes of deep drawing, forming, welding and joining.

Through its various integrated company operations, Christiansen Corporation is in a unique position to care for customer requirements. In purchase of its products you are assured of receiving continuous high quality of material designed or engineered for your specific needs.

The Christiansen Corporation policy of guaranteed quality and service offers an efficient buying course for you.

EDCO
CHRISTIANSEN CORPORATION

CHRISTIANSEN CORPORATION

1515 N. KILPATRICK AVE., CHICAGO 51, ILLINOIS

Plants • Chicago, Illinois
East Chicago, Indiana
Chicago Heights, Illinois

ONE WHEELABRATOR

Slashes Cleaning Costs 38%

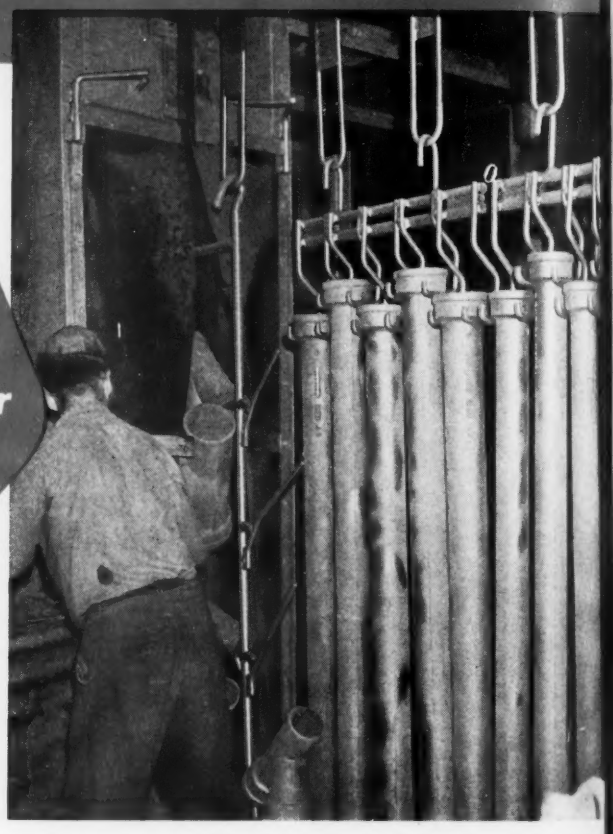
Cuts Operating Labor 69%

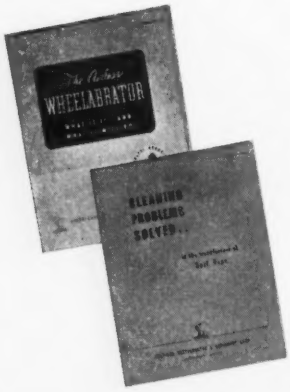
Cleaning Soil Pipe and Fittings at the

ANTHES-IMPERIAL COMPANY, Ltd.

St. Catharines, Ontario

16 tons of soil pipe per hour enters here





Send for this descriptive catalog containing complete, concise information on all phases of airless blast cleaning. Ask for catalog No. 74-A. If you are producing soil pipe or fittings you will find Bulletin No. 444 of invaluable assistance.

American

WORLD'S LARGEST BUILDERS

In a few hours' time a Wheelabrator Cabinet cleans the daily production of soil pipe and fittings that formerly required nearly 24 hours by tumbling. In addition to this drastic slash in cleaning time, the Wheelabrator reduced cleaning costs 38%, cut operating labor 69% and greatly improved working conditions.

The finish imparted to the castings is sparkling and uniformly clean. This is due to the abrasive barrage of four Wheelabrator units which completely removes all sand as the castings are automatically conveyed through the machine. A continuous flow . . . over 16 tons per hour . . . is maintained.

Use of the Wheelabrator provided these additional benefits:

1. *Complete absence of dust and irritating noise.*
2. *Improved efficiency in the cleaning room.*
3. *Cleanliness of operation.*
4. *Assures a uniformly cleaned product.*

As manpower gets tighter the labor-saving, time-cutting advantages of Wheelabrating increase in their importance. Let us show you what the Wheelabrator can do for you. There is no obligation, of course.

leaves here perfectly cleaned

How the WHEELABRATOR Can SAVE for You

Faster Cleaning—Airless Wheelabrator throws more abrasive and throws it harder.

Better Cleaning—Many casting users now demand a Wheelabrated finish.

Power Savings—Range as high as 80% or 90%.

Faster Machining and Grinding—Wheelabrator removes every trace of sand and scale right down to virgin metal.

Labor, Space and Equipment Savings—A single Wheelabrator handles same production as a battery of tumbling mills or airblast equipment.

Easier Inspection—Surface defects, cracks, blow holes, etc. are quickly detected before machining.

WHEELABRATOR & EQUIPMENT CORP.

505 S. Byrkit St., Mishawaka 2, Indiana

OF AIRLESS BLAST EQUIPMENT

AIR TOOLS ENABLE WORKMEN TO PRODUCE MORE WITH LESS EFFORT

That's why, under today's conditions, compact, powerful Ingersoll-Rand Air Tools now pay for themselves nearly twice as fast as a few years ago.

IMPACTOOLS	threaded fasteners up to 4" diameter
RIVETERS	rivets up to 1¼" diameter
DRILLS	up to 3" diameter in steel
REAMERS	up to 4" diameter in steel
TAPPERS	up to 4" in steel
TUBE ROLLERS	up to 6" diameter
CHIPPING HAMMERS	cleaning castings, chipping plate and tubing
GRINDERS	up to 8" diameter wheel size
TAMPERS	for compacting foundry sands and backfill materials
SCREW DRIVERS	screws up to 5/16" diameter
AIR HOISTS	up to 20,000 lbs.
DIGGERS	for hardpan, clay, gravel, frozen ground, etc.
SUMP PUMPS	up to 250 gallons per minute
SCALING HAMMERS	cleaning rust, scale, paint, etc.
CONCRETE VIBRATORS	for stronger, more uniform concrete

Call your Ingersoll-Rand office for a demonstration or trial in your own plant. Write for Form 5010A, a booklet of interesting case histories telling how Air Tools quickly pay for themselves in all industries.

540-8

AIR POWER ... The Key to Lower Production Costs

Ingersoll-Rand

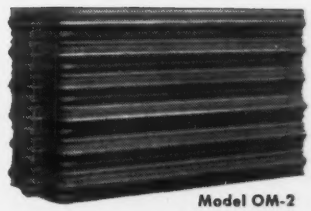
11 Broadway, New York 4, N. Y.

COMPRESSORS · AIR TOOLS · ROCK DRILLS · TURBO BLOWERS · CONDENSERS · CENTRIFUGAL PUMPS · OIL AND GAS ENGINES

"We need one-man flasks"

Model OM-1
Truscon Flask
for One-Man Handling.

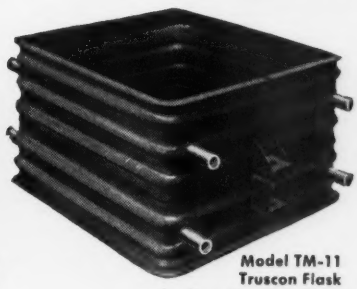
Model OM-4
Truscon Flask
for One-Man Handling.



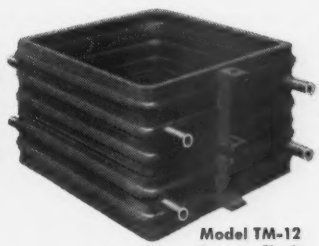
Model OM-2
Truscon Flask
for One-Man Handling

"We need two-man flasks"

Model TM-10
Truscon Flask
for Two-Man Handling



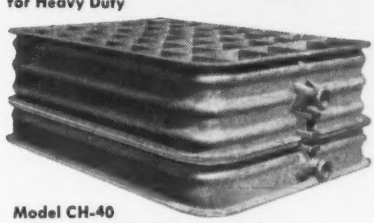
Model TM-11
Truscon Flask
for Two-Man Handling.



Model TM-12
Truscon Flask
for Two-Man Handling

"We need crane flasks"

Model CH-30
Truscon Flask
for Heavy Duty



Model CH-40
Truscon Flask for Extra Heavy Duty.

Model CH-20
Truscon Power Handled Flask.

Truscon supplies them all!

Over 20 years of experience in flask engineering and production has given Truscon a know-how that is outstanding in the industry.

Exceptional strength and rigidity are built into Truscon Steel Flask walls.

The ribs and flanges extend full depth around the entire flask without buckling or cutting away the metal. The flange on the filling side is turned out so it will not interfere with filling or shaking out. The flange on the bottom side or parting line is turned in, forming a sand strip to carry the sand.

A wide range of welded handles and pin lugs is available. Every Truscon cope, drag and check is one integral piece of steel.

Write for catalog showing the wide range of Truscon Steel Flasks that can be manufactured.

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MARK OF MERIT
PRODUCTS

TRUSCON STEEL COMPANY

PRESSED STEEL DIVISION • 6202 TRUSCON AVENUE • CLEVELAND 4, OHIO
SUBSIDIARY OF REPUBLIC STEEL CORPORATION

KEEP THE CLEANING ROOM "CLEAN"

● Improved B5 and B7N resinoid bonded snagging wheels by CARBORUNDUM are moving more castings—faster, more efficiently and at less cost through foundry cleaning rooms daily.

They feature a high cutting rate—maintained throughout the life of the wheel—with less tendency to load. High productivity, less operator fatigue and increased safety through greater wheel strength are additional advantages.

B5 and B7N resinoid bond wheels are supplied in aluminum oxide abrasive for use on steel castings, forgings and welds, and in silicon carbide abrasive for cast iron, gray, white or chilled iron, and all nonferrous materials.

CARBORUNDUM offers a complete foundry abrasive service for stand, swing frame and portable grinders in B5 and B7N bonds.

Only CARBORUNDUM
TRADE MARK

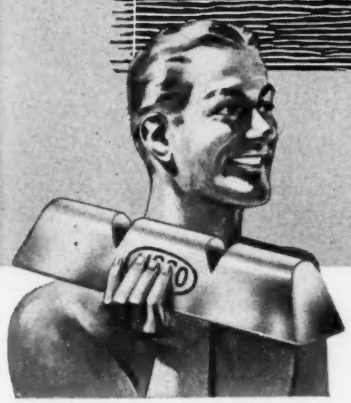
makes ALL Abrasive Products ...to give you the proper ONE

"Carborundum" and "Aloxite are registered trademarks which indicate manufacture by The Carborundum Company, Niagara Falls, N. Y.

USCO D-2

Looking for lower alloy costs? Select USCO D-2! This is an all-purpose 4% Cu 3% Si aluminum alloy, and, like all USCO products, it is produced under our famous Production Control System . . . has been job tested and approved. A few of its advantages are: good castability—excellent machining and finishing properties—less shrinkage. Ask your USCO man about D-2 now.

FREE USCO Aluminum Alloy Selector. A handy aid to analysis, specifications and many other foundry problems.



For 47 years, pioneers in aluminum development.

USCO

ALUMINUM

U. S. REDUCTION CO.

East Chicago, Indiana

When a TAM* field engineer calls...

You can obtain a wealth of practical, useful and authoritative information by discussing your technical problems with a TAM sales engineer. He's well equipped to work for and with you. More than ten years ago he received his degree in Metallurgical Engineering from one of our leading universities. Since then, his education has been broadened by wide experience. In the field, he has been called upon to assist in the solution of simple and complex problems. He has had his coat off and his hand-in on more than a few plant projects. His advance information on new metallurgical developments and applications is a valuable asset.

Here is a man ready to work with you. You will find him intelligent and cooperative—quick to understand your problems. Furthermore, he is your direct contact with a fully equipped and staffed headquarters that is the source of much worthwhile information and data. When your TAM engineer calls, get the full value that his background offers you.

TAM PRODUCTS
Registered U. S. Pat. Off.

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TITANIUM ALLOY MFG. DIVISION
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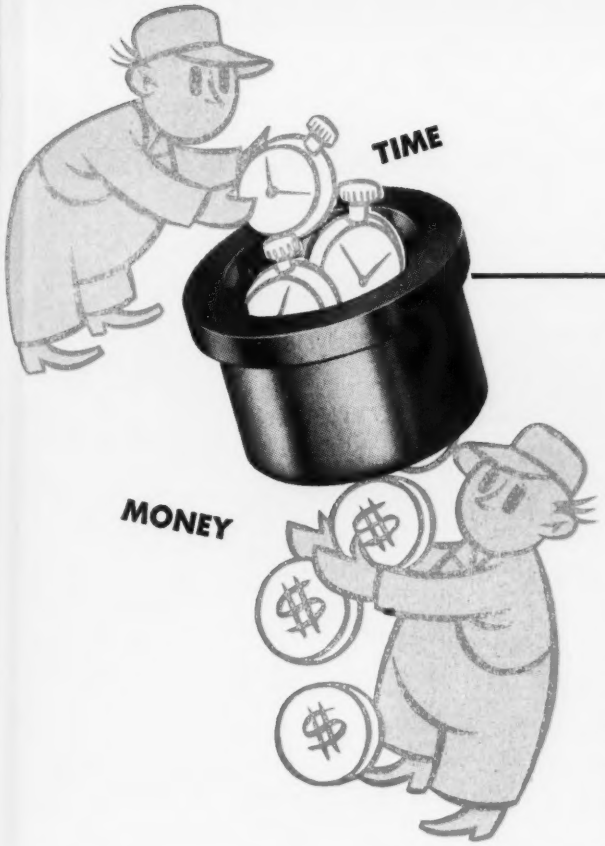
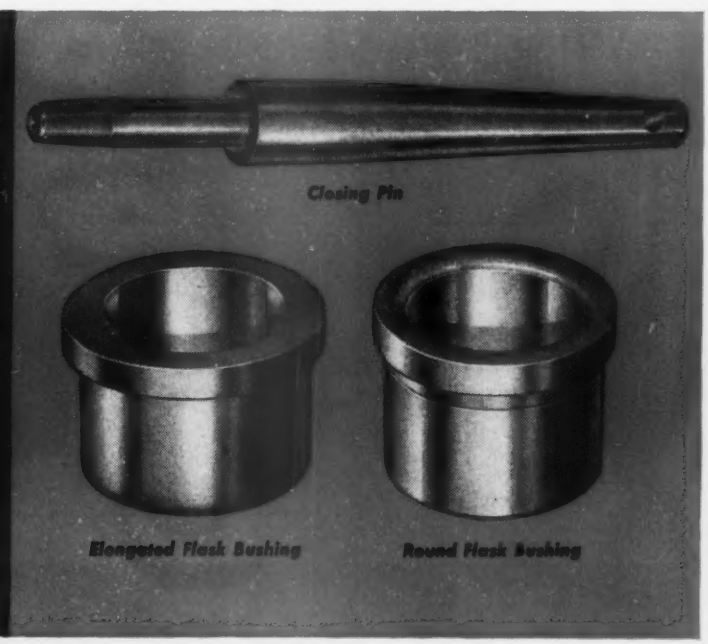


UNIVERSAL flask pins and bushings can convert wasted time into money in your foundry

Universal Flask Pins and Bushings save precious minutes by assuring instant, accurate alignment of cope and drag. Since they are heat-treated and precision ground from high quality steel to stand up under rough treatment, Universal Flask Pins and Bushings also save the cost and down-time that replacement always requires. Cope Bushings are quickly guided to Drag Pins over tapered, loose-fitting Closing Pins which are easily removed after assembly. The special elongated Flask Bushing is designed to permit longitudinal expansion to compensate for metal heat *without affecting accurate alignment*. Standard sizes are carried in stock — special sizes and types to order. Direct your inquiries and orders to the office nearest you — 1060 Broad St., Newark, N. J., and 5035 Sixth Ave., Kenosha, Wisconsin — or write to our home office.

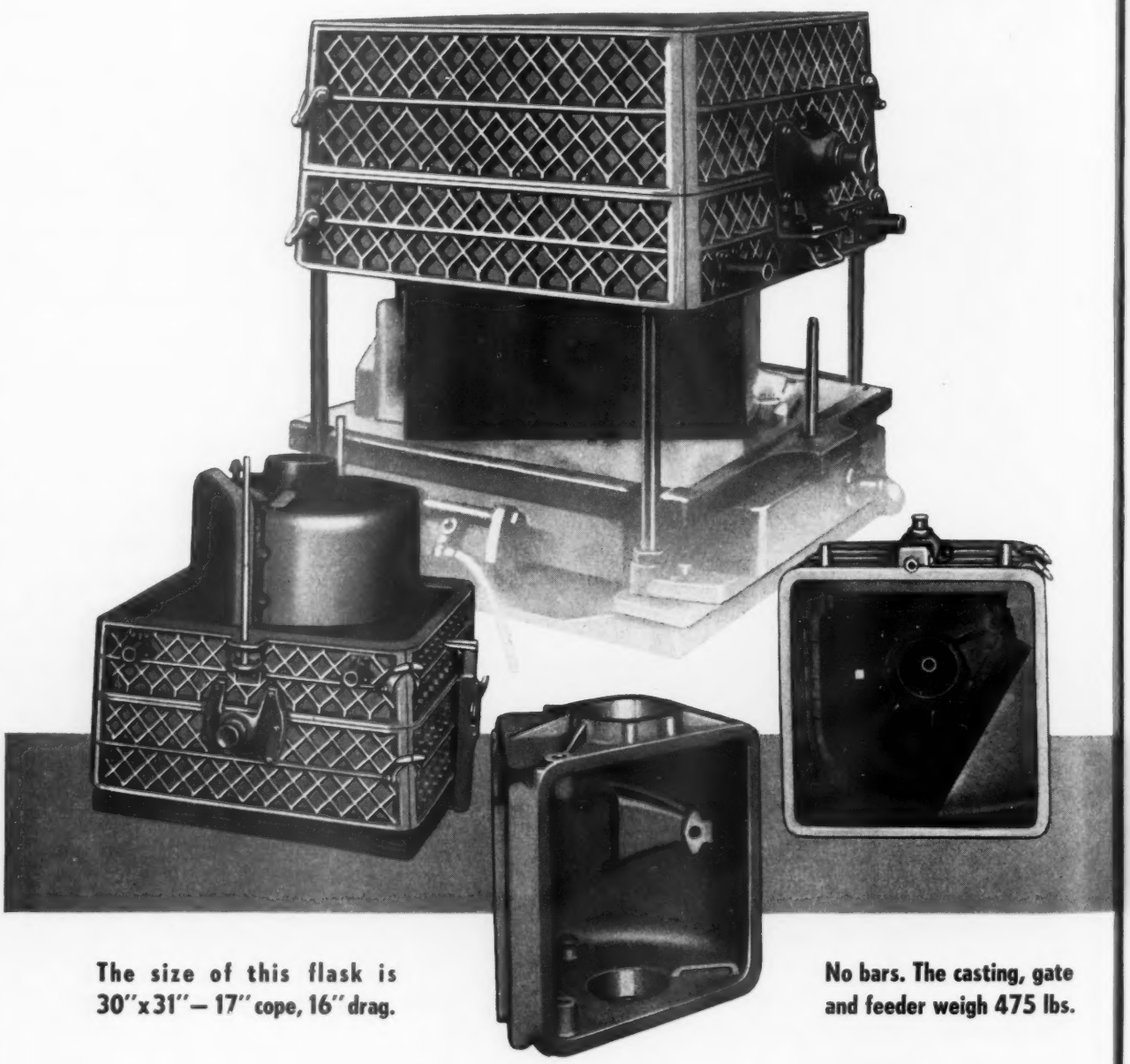


147

UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 4, MICHIGAN

HINES can help you solve



The size of this flask is 30"x31"—17" cope, 16" drag.

No bars. The casting, gate and feeder weigh 475 lbs.

THE HINES

3431 WEST 140th STREET

eyour Manpower problems

You don't need 50 flasks to make 50 castings. Just one Hines POP-OFF Flask will do all and more than 50 tight flasks will do. You'll make heavy castings successfully at much lower costs than when made in tight flasks. Here's why: because there's less equipment to handle; because you won't have stacks of tight flasks taking up valuable foundry space; because you'll eliminate shake-out costs—just upset the mold and hook casting out.

Shown in chart at right are sizes of just a few HINES Aluminum POP-OFF Flasks that have replaced a set of tight flasks. These are only typical, as we have records of many others, in a wide variety of sizes, that are on the job, reducing handling and costs.

Why not find out how Hines POP-OFF Flasks and Jackets can help you? Write for information and prices.

Width	Length	Depth	
		Cope	Drag
36"	36"	6"	6"
15"	75"	8"	5"
30"	31"	17"	16"
14"	53"	10"	4"
12"	56"	5"	5"
34" diameter		6"	5"

FLASK CO.

CLEVELAND 11. OHIO

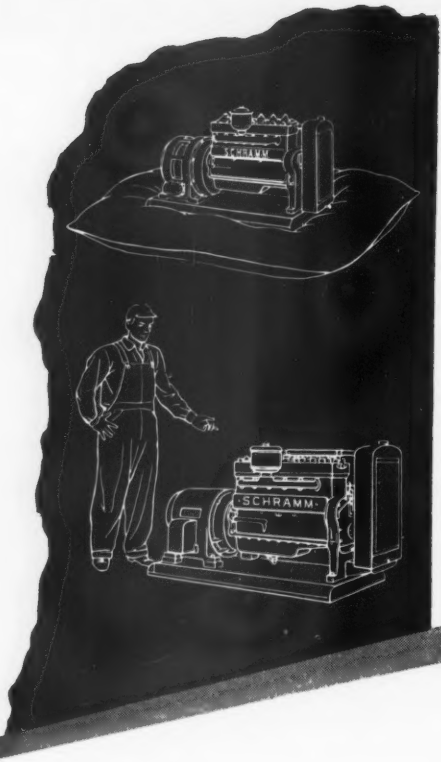
features

OF SCHRAMM AIR COMPRESSORS Mean Savings To You!

Many advantages are offered you by Schramm Air Compressors.

Vibrationless

Compact



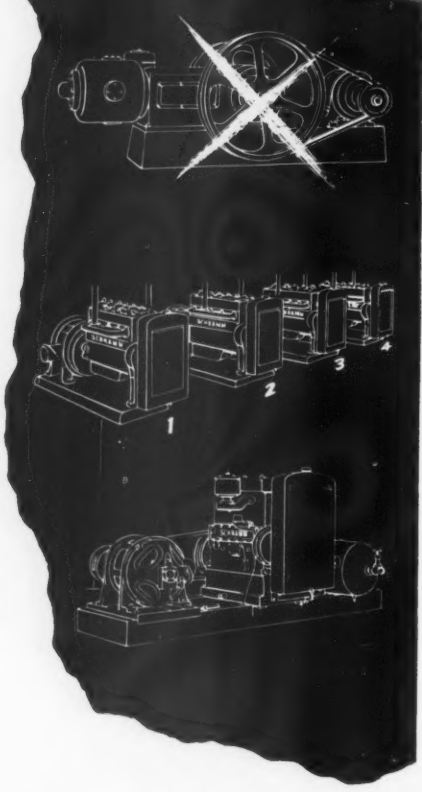
EASY TO MOVE

"Air when you want it"

One cost— no elaborate foundation

Unit system

Complete package— easy to install



One of the chief advantages of Schramm is its ease of moving. When your plant layout changes . . . or you need an air compressor in a different building . . . the quickest way to transfer and make installation is to use a Schramm. It is compact, easy to handle because compressor and motor are mounted as a single unit on a substantial steel base, which also serves as a foundation.

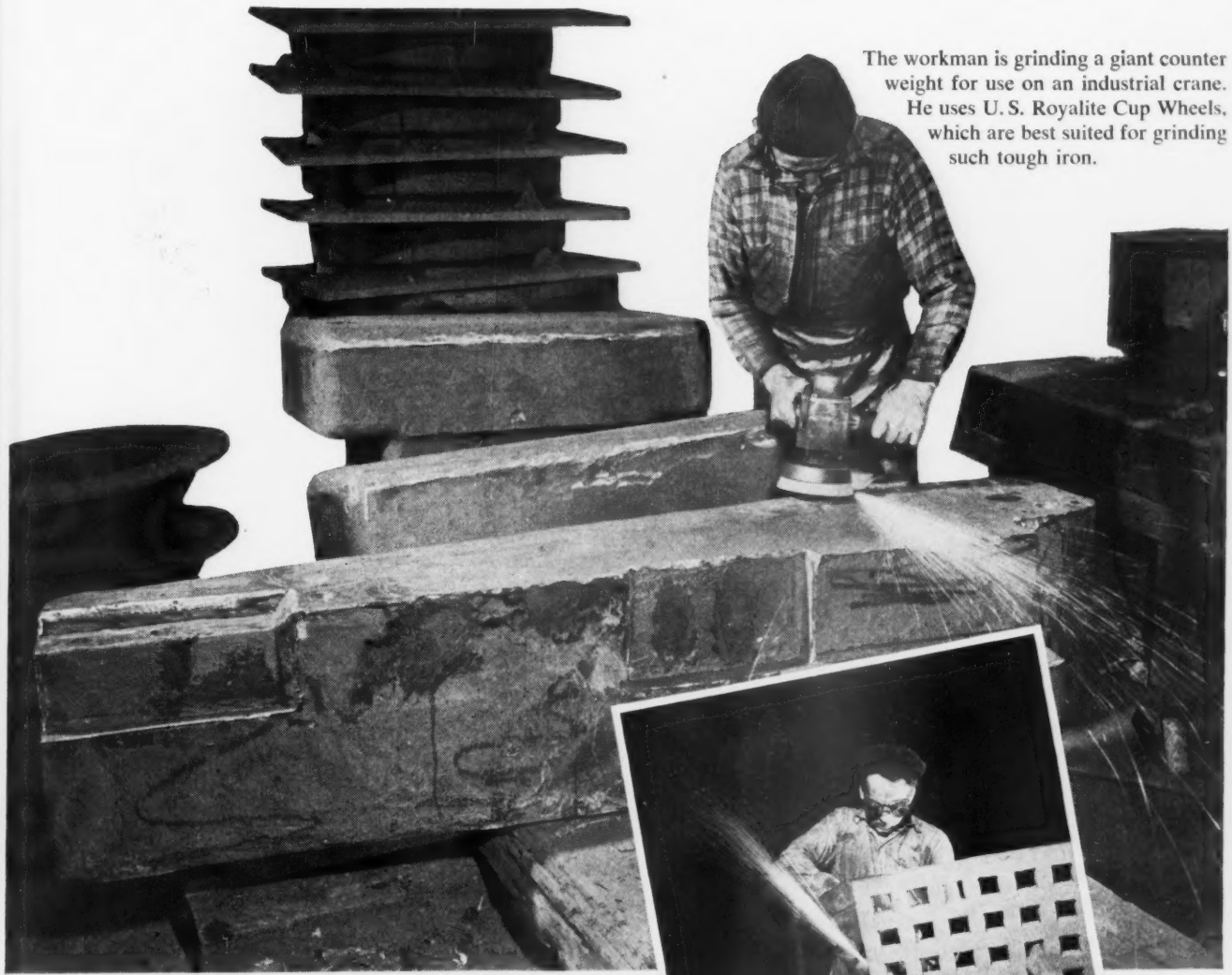
For your many compressed air jobs about the plant, specify Schramm—and save. Write today for folder STF-50.

SCHRAMM INC.

The Compressor People

WEST CHESTER • PENNSYLVANIA

What's U. S. Rubber doing to cut "gray iron" grinding costs?



The workman is grinding a giant counter weight for use on an industrial crane. He uses U. S. Royalite Cup Wheels, which are best suited for grinding such tough iron.

Specialists in abrasives at "U. S." have developed grinding wheels which grind fast and stand up well when used on castings of the toughest gray iron. That is why, like many a "U. S." customer, the foundry in which these pictures were taken uses "U. S." wheels exclusively.

For over 88 years, "U. S." has been developing wheels for the immense range of foundry grinding problems. Let U. S. Rubber technicians study your own requirements.

GRINDING A SEWER GRATE so it will fit smoothly into its frame. The grate must fit precisely or a tendency to rock will arise. Here again, U. S. Royalite Cup Wheels are used because the iron is of the toughest kind.

PRODUCTS OF
U.S.RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Well, I've tried 'em all -but I'll take DIXON'S!

You can't fool an experienced foundryman. Sometimes claims for crucibles may sound good to him... but it doesn't take him long to put a few crucibles into service and see for himself!

That's why we're always glad to have you test a Dixon "Carbond" Crucible.

So, when a Dixon salesman suggests to you, "Try a couple of Dixon Carbond Crucibles; *see for yourself* how many heats you get out of them, how clean they keep on the inside, how well they take the heat—and hold it too"... TAKE HIM UP ON HIS OFFER.

Remember, Dixon's Research and unequalled experience of over a century assure you of the last word in BALANCED crucible performance.

DIXON PRODUCTS

Crucibles
Stoppers
Refractory Cements
Base Blocks
Pre-formed Furnace Linings
Furnace Covers
Ladle Liners
Specialties

JOSEPH DIXON CRUCIBLE COMPANY

JERSEY CITY 3, NEW JERSEY

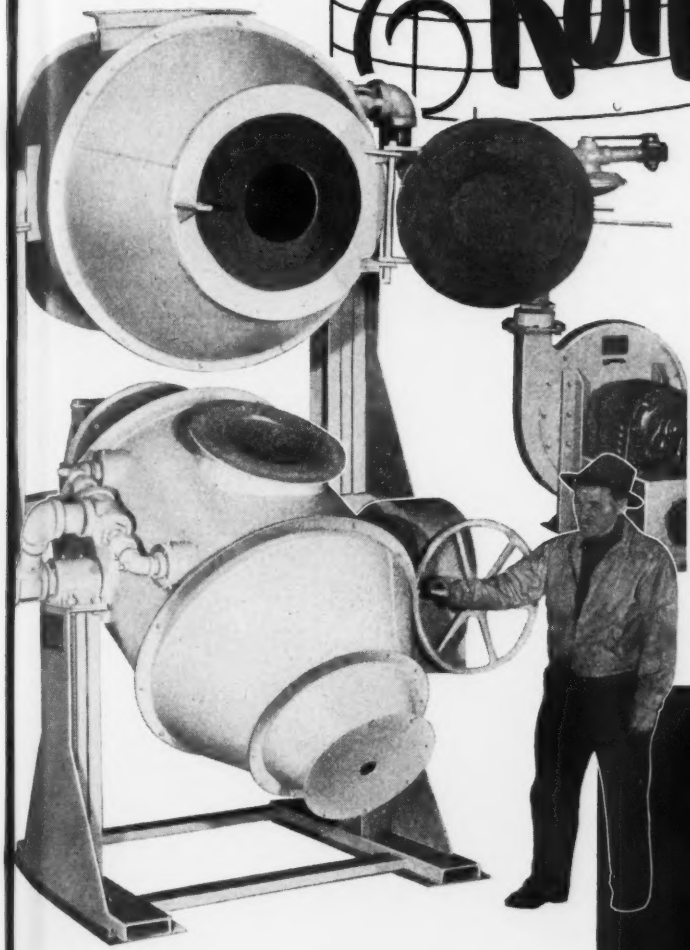
DIXON'S CRUCIBLES EXCELLENCE D SINCE 1827 STOPPERS & REFRACTORIES

Over a Century of Experience SPELLS THE DIFFERENCE

Roll Out the Barrel

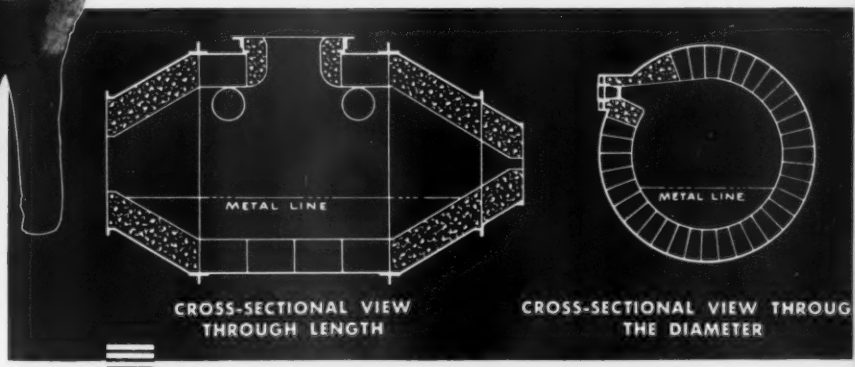
FOR MORE EFFICIENT ALUMINUM MELTING

This is the new Stroman Model "BFC" Hand Tilt Barrel Type Melting Furnace for aluminum. This furnace features "Tangential Firing" which produces a most efficient combustion condition and creates a melting atmosphere in the furnace that keeps metal loss and dross accumulation at a minimum. The furnace may be charged through the top or through the rear door which is also used for drossing the molten metal and cleaning the furnace. It hand tilts forward, as illustrated, for pouring and draining. It is available in 500 pound capacities and is ideal for use in all foundries that melt aluminum, no matter if they are sand casting, permanent mold, or die casting plants. Remember, when you buy Stroman you buy the best . . . for Stroman sets the pace in the non-ferrous metal melting equipment field . . . They are the undisputed leader in building the most efficient and economical furnaces available. Let them help you with your melting problems. Write for full information today.



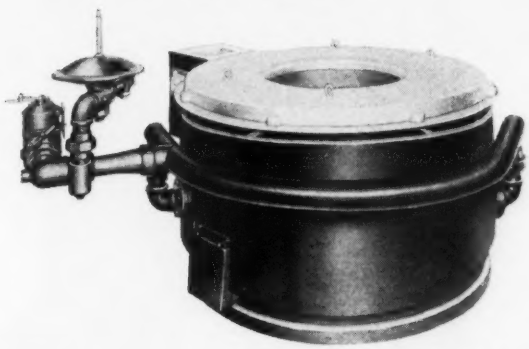
Top—Shows end charging and skimming door.

Bottom—Tilted in pouring position, showing top charging hopper.



CROSS-SECTIONAL VIEW THROUGH LENGTH

CROSS-SECTIONAL VIEW THROUG THE DIAMETER



STROMAN RM STATIONARY CRUCIBLE MELTING AND HOLDING FURNACES FOR ALUMINUM

Built especially for use in permanent mold and die casting plants where molten metal is dipped from furnace with a hand ladle. Melting is done in crucible (no iron pick-up). Thoroughly insulated to protect the operator from heat. Oil, gas or combination oil-gas fire. Capacities, 200 to 800 lbs. Available with full automatic controls.

STROMAN IRON POT MELTING FURNACES FOR ZINC OR ALUMINUM

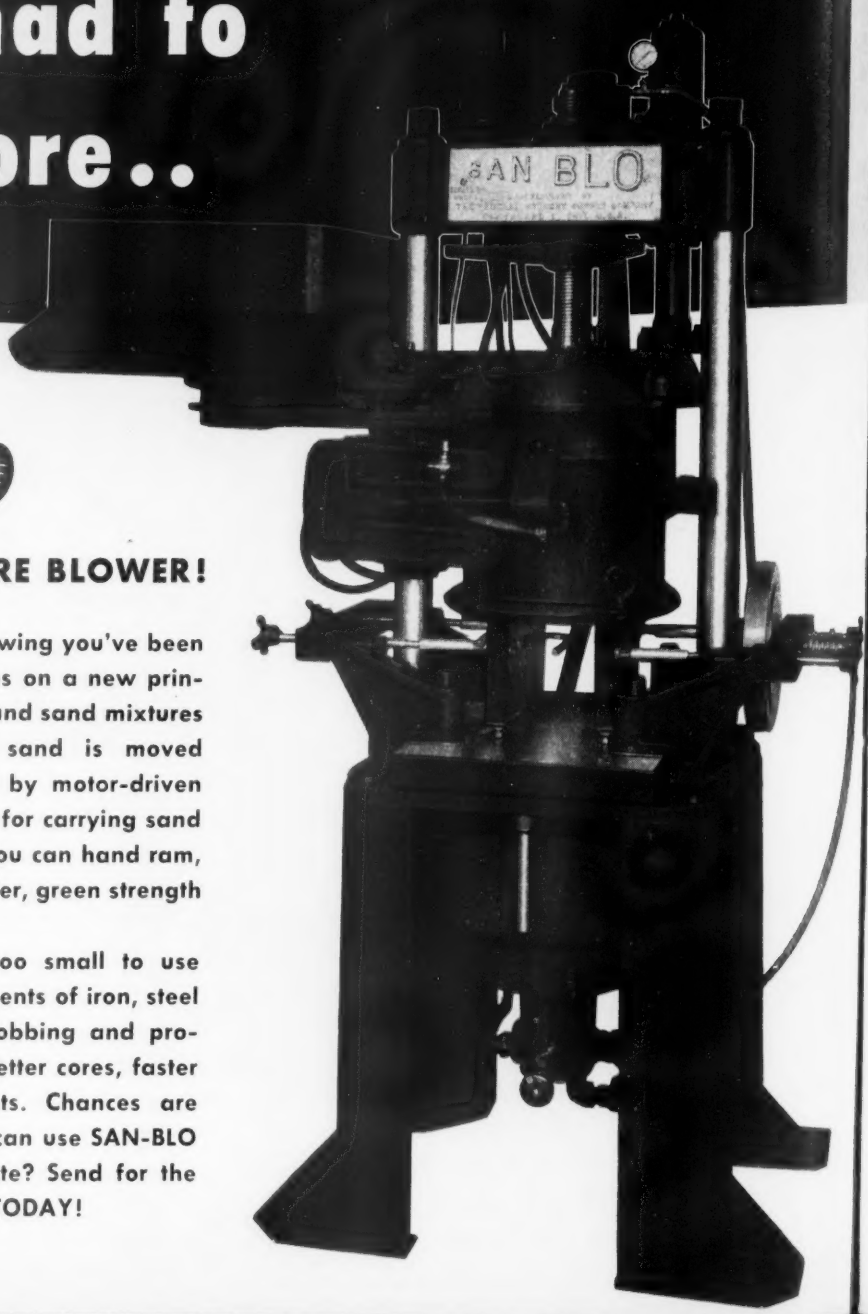
These furnaces are highly recommended as breakdown furnaces for zinc and aluminum die casting and permanent mold plants. They also excel as holding furnaces. They can be supplied either with or without hoods to exhaust fumes and heat. Their construction assures longest pot life and lowest fuel costs. Choice of automatic or manual controls and oil or gas fire. Capacities from 212 to 14,000 lbs. zinc.

STROMAN FURNACE & ENGINEERING CO.

DIVISION OF

THE PETERSEN OVEN CO. • 9900 FRANKLIN AVE. • FRANKLIN PARK, ILL.

You can now *blow* cores and sand mixtures you've always had to ram before..



With the new

SAN-BLO

THE ALL-PURPOSE CORE BLOWER!

Forget the limitations on core blowing you've been accustomed to! SAN-BLO operates on a new principle that permits blowing cores and sand mixtures never blown before. Because sand is moved mechanically in the blow head by motor-driven plows, full air pressure is utilized for carrying sand into the core box. So, any sand you can hand ram, can be blown—regardless of binder, green strength or moisture content.

No foundry is too large or too small to use SAN-BLO. It has met the requirements of iron, steel and non-ferrous foundries—of jobbing and production foundries. It is blowing better cores, faster—and reducing core room costs. Chances are excellent that your foundry, too, can use SAN-BLO to advantage. Why not investigate? Send for the new 8-page SAN-BLO booklet—TODAY!

The **FEDERAL FOUNDRY**

4600 EAST 71st STREET • CLEVELAND

SALES OFFICES: CHICAGO • DETROIT • MILWAUKEE • NEW YORK • CHATTANOOGA

Here's what SAN-BLO *users tell us*

Wehr Steel Co., Milwaukee: "Upon purchasing the SAN-BLO unit, we found that we could blow mixes which previously could not be blown in our conventional type blowers."

Aircraft Foundry Co., Huntington Park, Calif.: "SAN-BLO's adaptability to all types of cores has proven to be of immeasurable value in that we are a jobbing foundry and every type of core imaginable must be made."

Atlantic Foundry Co., Akron: "The simplicity of SAN-BLO for making fast changes, for both short and long runs, really fits into the 'picture' for jobbing foundries."

SEND FOR THIS NEW

8 Page Booklet

Here's complete information on the sensational, all-purpose SAN-BLO. Full descriptions and specifications on Bench, Floor and De luxe Models. Accessory data. Case histories. Use coupon below or write on company letterhead.

UPPLY *Company*

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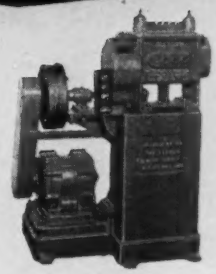
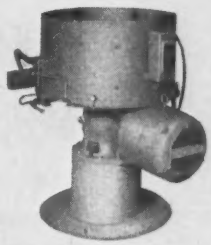
ARE YOU READY FOR *Defense Orders?*

PROMPT SHIPMENT can be made on this equipment

CLIMAX
Wire Straightener

Conserve steel—reclaim wire and rods. Easy and safe to operate. Six models offer choice of drives and wire sizes.



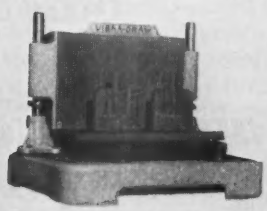


WHIRLMIX
Sand Mixer

Flexible, whirling arms mix sand safely—no overheating, no crushing of sand grains. Compact, easily moved.

LOWE Electric Sifter

Reduces costs through faster sifting and better sand conditioning. Greater shoveling room and screening area. Enclosed ball-bearing motor, rugged construction.



VIBRA-DRAW
Core Drawing Machine

Anyone can draw perfect cores on VIBRA-DRAW . . . and fast! Simply place core box against vibrating head and lift.

SHUR-SPOT Sprue

Makes a completed, properly located pouring sprue, automatically. Pops up to be lifted out. For use only on squeezer-made molds.

FEDERAL FOUNDRY SUPPLY CO.
4600 East 71st Street
Cleveland 5, Ohio

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

Please send literature on the following:

- ☐ SAN-BLO Core Blower
- ☐ CLIMAX Wire Straightener
- ☐ WHIRLMIX Sand Mixer
- ☐ LOWE Electric Sifter
- ☐ VIBRA-DRAW Core Drawer
- ☐ SHUR-SPOT Sprue

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cost conscious?
quality conscious?

. . . and what executive isn't?
Industrial Pattern Works have
found answers to such problems
as how to produce better cores
with less core box expense—
how to reduce scrap in both
foundry and machine shop—
how to increase precision to
final dimensions, and many
other worth-while objectives.

Let us explain the advantages of DUPLICAST core boxes in achieving these results. Samples on display at I. P.W. Headquarters, Hotel Lenox, Buffalo.

INDUSTRIAL PATTERN WORKS

2621 W. BELMONT AVE., CHICAGO 18, ILLINOIS

PATTERN AND CORE BOX ENGINEERING SERVICE

Newport News Shipbuilding & Drydock Co., Newport News, Va.

this foundry is a good place to work

ESTABLISHED in 1886 this company has wide spread, diversified facilities covering about 225 acres. Its production ranges from shipbuilding to rayon-yarn spinning machinery, paper-making machinery, steel pipe lines, pressure vessels, tanks, valves, gates and hydraulic turbines.

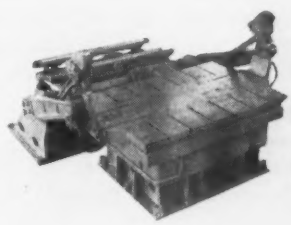
Foundry facilities, with nearby pattern shop, cover an area of 11 acres. Iron casting output is in excess of 2,000,000 lbs. per month.

It has pursued a consistent policy of modernization to acquire its reputation as a good place to work. Equipment includes modern belt-conveyor systems for sand handling, rotary dryers and up-to-date shakeout equipment; the foundry was one of the early users of the Randupson process, employing cement as a binder; modern melting equipment, with varying capacities, is used in producing iron, steel and brass castings.

Inspection equipment meets the most exacting standards; the company has had a training program for 60 years, with a junior college rating; it maintains clinics, and on-the-job training.

Herman Molding Machines are an integral part of Newport's good-place-to-work picture. Primary reasons why they help in that direction are their simplicity and efficiency. Like the 10,000 lb. capacity machine illustrated, *all* Hermans have automatic lubrication; one rotary valve handles the complete cycle; no power is required for the roll-back operation.

Herman Molding Machines, at Newport and throughout the world, have made their way by the way they're made.

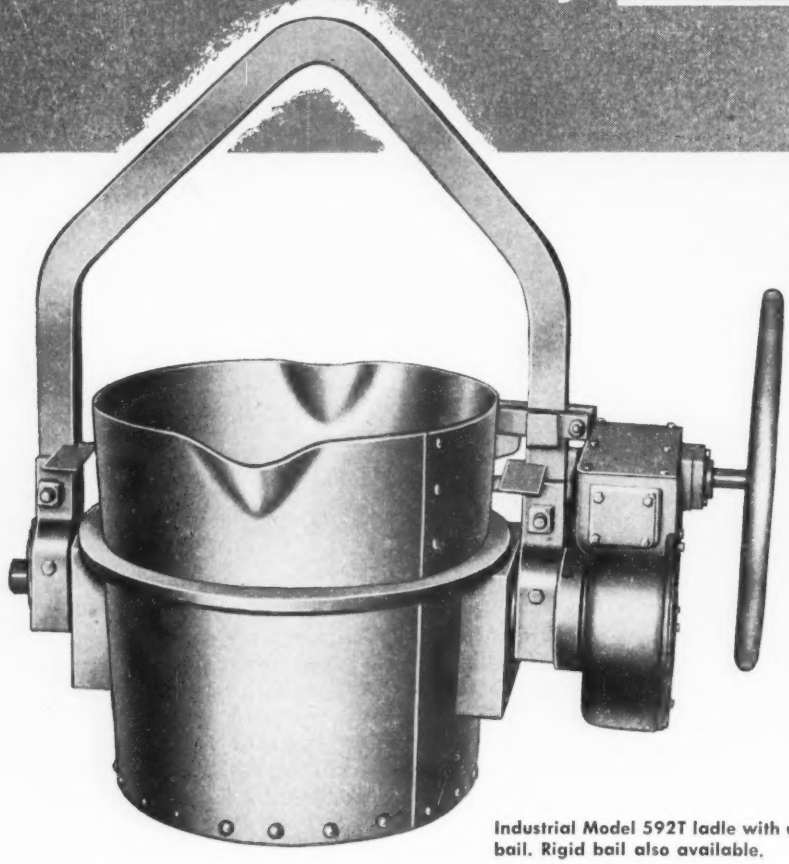


FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

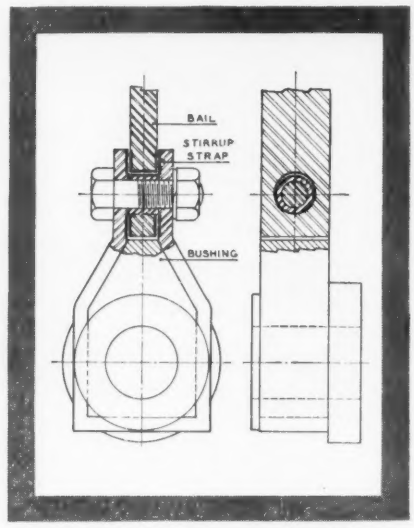
Herman MOLDING MACHINES

HERMAN PNEUMATIC MACHINE CO., UNION BANK BUILDING, PITTSBURGH, PA.

AT LAST... Binding due to heat distortion COMPLETELY ELIMINATED in this revolutionary Universal Bail Design



Industrial Model 592T ladle with universal bail. Rigid bail also available.



More flexibility than a universal joint. Ample vertical and horizontal adjustments. Misalignment taken care of by rotating swivel action.

Here is one of the really fundamental advances in geared ladle design. Binding problems caused by the steady rise in pouring temperatures have been solved . . . with no sacrifice in strength, safety, or simplicity.

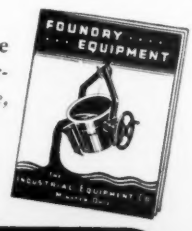
You get four distinct advantages with this new universal bail by Industrial Equipment:

1. **Binding due to heat distortion is eliminated.**
2. **Binding due to misalignment is eliminated.**
3. **Gear wear due to binding is eliminated.**
4. **No lubrication or adjustment is ever needed.**

This new bail is the result of a project on which Industrial Equipment has been working for over four years. Many novel and ingenious designs were proposed and discarded before the final design was accepted. Like all good things it is simple. Yet notice that in addition to simplicity it is rugged, safe, and dependable.

You should also know that this new bail has been thoroughly foundry tested. We emphasize this because the more severe the conditions, the more evident was its design superiority. Operators, for example, say they have never operated a ladle that was easier to handle *regardless of conditions.*

Look to Industrial Equipment for the really basic improvements in foundry pouring and handling equipment. *Write, wire, or telephone today for full details.*

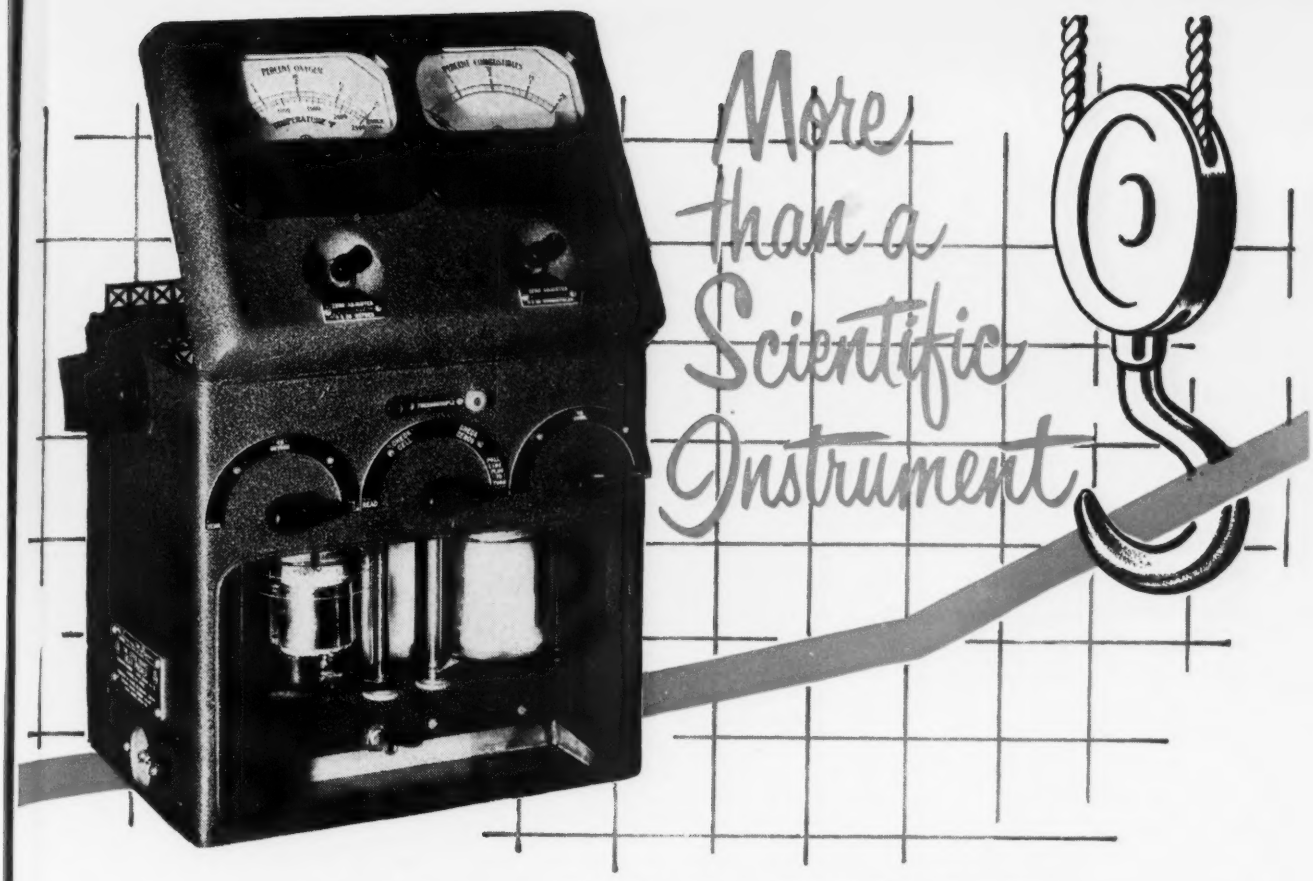


Do you have our revised catalog No. 35?

Industrial EQUIPMENT CO.

115 N. OHIO ST., MINSTER, OHIO

LADLES • BOWLS • SHANKS • BAILS • TONGS • SPECIAL EQUIPMENT



A HOIST FOR YOUR PRODUCTION CURVE

Are you wasting furnace fuel? ☐

Is excess (scale-making) oxygen present? ☐

Are you paying needlessly to heat excess air? ☐

Facts that answer these vital questions are promptly supplied by the Cities Service Heat Prover. This exclusive flue gas analyzer strictly checks combustion factors. Then sources of loss can be traced and corrected. Operators of all types of furnaces report they have been able to clamp down on cost and step up production, simply by using the Cities Service Heat Prover. Find out how easily you can arrange to put it on the job. Send the coupon.

A complete line of petroleum products for the Metal Fabricating Industry including:

- ★ Chillo Cutting Oils
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⇩ This coupon brings complete details in your copy of "Combustion Control for Industry."

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

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Sixty Wall Tower, Room 769
New York 5, New York

Please send me without obligation, a copy of "Combustion Control for Industry."

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Company_____

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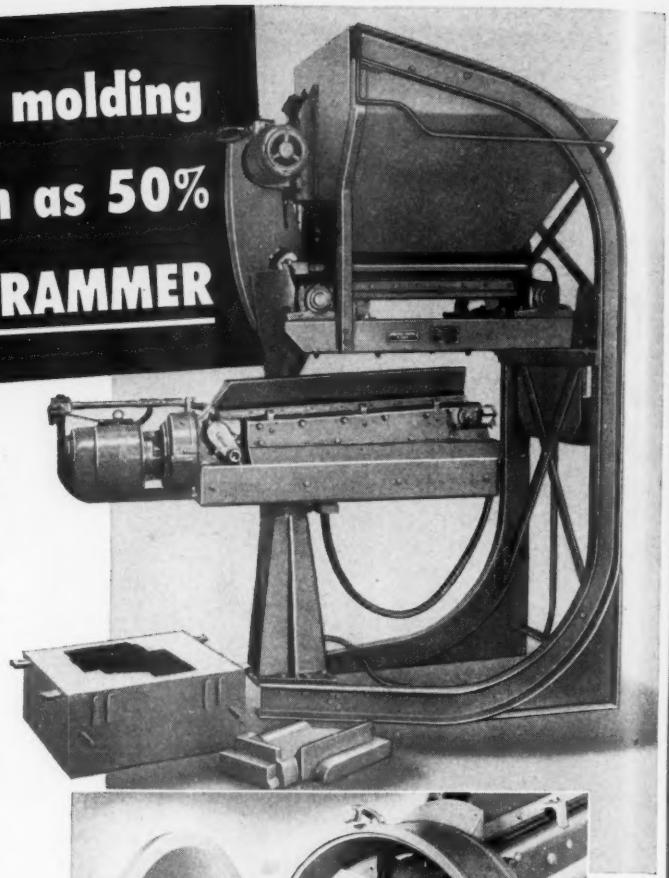
TABOR SAYS...Reduce molding costs by as much as 50% with "JUNIOR" SANDRAMMER



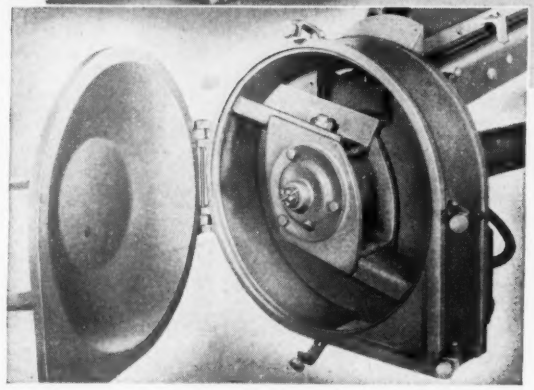
GREATER RAMMING SPEED AND FLEXIBILITY are the reasons behind "Junior's" ability to cut costs.

SPEED—The new-type Impellor Head rams molds at a phenomenal rate. Trolleys and swivels are finely balanced, ball-bearing mounted for ease of operation. Simple, sequence, push-button controls are at the operator's finger tips.

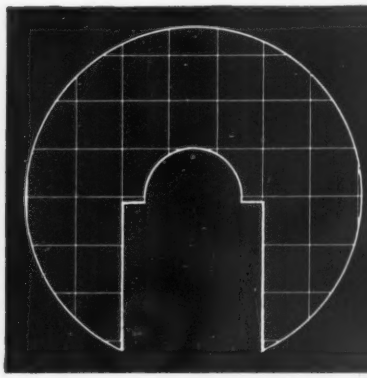
FLEXIBILITY—"Junior" quickly pays for itself in core room or on small jobbing floor. Ideal for ramming up molds from loose patterns, for short-run core making, and for handling light to medium production work in both core room and foundry. Can be moved by crane from area to area, or mounted on rail-car for along-track ramming. Adaptable to hand, hoist, or over-head system sand feeding.

PLUS—Low original cost, long trouble-free life, low operating and maintenance costs.

Summed up, "Junior" Sandrammer is a machine you can keep at work *all day, every day.* That means sound investment—quick pay-off.



Adjustable, multi-blade impellors give greater ramming speed and five-fold life. Simple blade adjustment compensates for wear and controls density of mold. Rams mold with equal density throughout whole area and depth.



The blocked portion of this diagram shows working floor area covered by ramming head of "Junior" Sandrammer. Since each block represents one square foot, this sketch quickly tells you the combined maximum lengths and widths of molds which the "Junior" can handle.

"JUNIOR" SPECIFICATIONS

Height from floor to top of hopper	8'- 8¾"
Height from floor to sand discharge point	2'-10½"
Max. height of flask	2'- 9½"
Hopper capacity	675 lbs.
Sand throwing capacity	Up to 150 lbs. per minute

Write, wire or 'phone.
A Tabor engineer will be ready to team up with you.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

The TABOR *Manufacturing Co.*

SINCE 1884 MANUFACTURERS OF FOUNDRY MOLDING MACHINES
6225 TACONY STREET • PHILADELPHIA 35, PENNA.

Tabor Manufacturing Co. is licensed to manufacture and sell Sandrammers by Foundry Equipment, Ltd., Leighton Buzzard, Bedfordshire, England.

THE wheel assembly illustrated above has been coated with Tousey Casting Sealer to protect it against wear and to extend its period of usefulness. Such a sealer must be resistant to all forms of abuse and, in addition, be non-bleeding and non-toxic.

Tousey Casting Sealers are used in major foundries everywhere — coating axle housings, motor blocks, tractor frames and transmission cases — giving extra protection to this heavy duty equipment and proving again and again—***Tousey Finishes Can Take It!***

TOUSEY VARNISH COMPANY

520 W. 25th St., Chicago 16, Illinois

for maximum economy
on every rough grinding job....
NORTON
ABRASIVES

. . . Specify NORTON WHEELS —

— Wheels with the *Right Combination* of *Cutting Action* and *Long Wheel Life*

YOU foundrymen know just what type of wheels you need to handle your rough grinding jobs quickly, easily and most economically. Maybe **fast cut** spells maximum economy for you. Maybe extra **long wheel life** is your primary requirement. There's a definite combination of cutting action and wheel life that will keep your rough grinding costs down.

Norton can supply wheels with just the combination you need—because of its research facilities, engineering skill and wide product variety. You'll find a Norton wheel with exactly the right combination of abrasive and bond, and in just the right size and shape to produce the cost-cutting results you're after.

Let your Norton distributor or abrasive engineer study your rough grinding jobs and help you to select Norton wheels of ALUNDUM, 15 ALUNDUM, 57 ALUNDUM or CRYSTOLON abrasive and B-5, B-7, B-H resinoid or vitrified bond. He'll help you to select exactly the right wheels for maximum economy on each operation.

You'll find many helpful rough grinding tips and scores of cost-cutting specifications in the Norton booklet, "Rough Grinding." Send for your copy of Form 1405-B-2.

NORTON COMPANY
WORCESTER 6, MASS.

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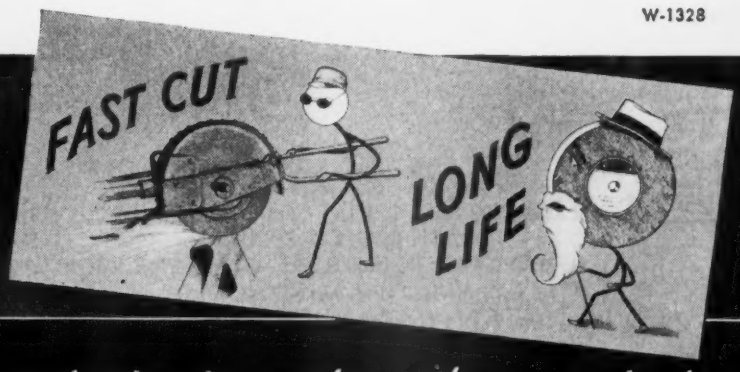


Making better products to make other products better

AIRCO MACHINE GAS CUTTING

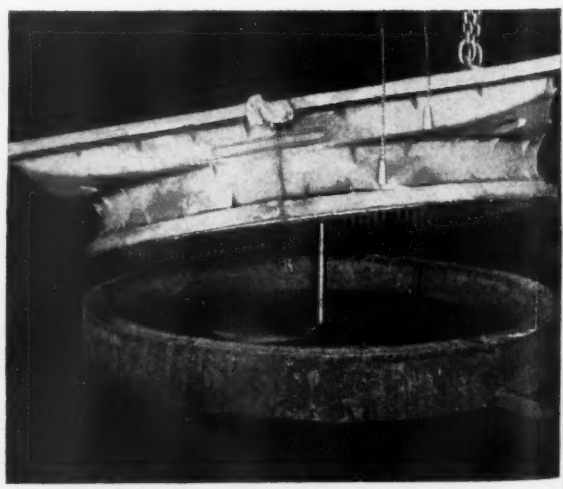
...speeds riser removal
...minimizes grinding
...increases accuracy
...reduces operator fatigue

Cutting risers with an Airco gas cutting machine saves time, greatly decreases grinding and/or machining—and by reducing operator fatigue, it increases and speeds-up production.

Here, for example, is illustrated a simple machine set-up that permits fast, accurate riser cutting. Using an Airco Radiagraph, the casting — measuring 105″ in diameter and 5″ in thickness — is trimmed at a speed of 5″ per minute. More important, the Radiagraph cuts so close to final machining specifications that slow expensive machine work or grinding is eliminated, and a costly production bottleneck is done away with.

This actual case history demonstrates the advantages of removing gates and risers by machine gas cutting. Airco gas cutting machines are easily adaptable to any cutting requirements — straight line, circle, or bevel-edge cuts.

If you would like further details on how machine gas cutting, as well as other Airco oxyacetylene processes can save time and money for your foundry operation, call or write your nearest Airco office — today.



Top photograph shows the simple set-up that makes easy work of a tough job. Above you see the clean, accurate cut, ready for machining.

AIRCO

AIR REDUCTION

AIR REDUCTION SALES COMPANY • AIR REDUCTION MAGNOLIA COMPANY
AIR REDUCTION PACIFIC COMPANY
REPRESENTED INTERNATIONALLY BY AIRCO COMPANY INTERNATIONAL
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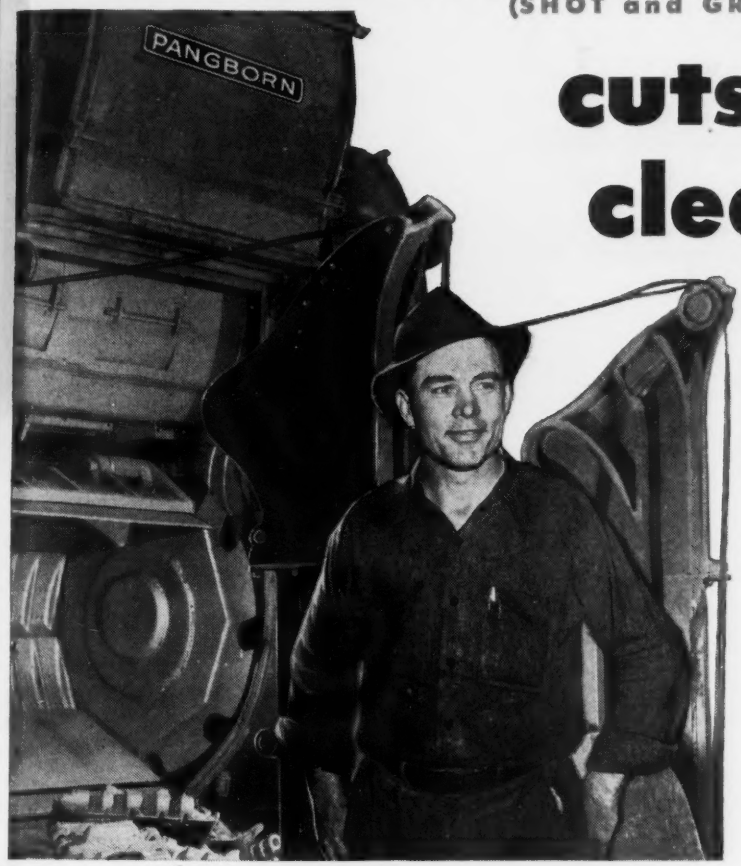
TESTS PROVE

MALLEABRASIVE®*

(SHOT and GRIT)



cuts blast cleaning costs

57.2% Company A

51.8% Company B

35.9% Company C

58.9% Company D

Yes, these actual reports from four leading foundries† prove Malleabrasive saves up to $4000 per machine per year, cuts cleaning costs 50% and more.

TESTS LIKE THESE PROVE again and again that Malleabrasive lasts 2 to 4 times as long as ordinary chilled shot and grit. With Malleabrasive in your plant, wearing parts last up to 3 times longer . . . costly machine down-time is cut, material handling costs drop and tonnage cleaned per hour goes up. Total cash saving with Malleabrasive can often amount to 50% to 60% of your blast cleaning costs.

TEST MALLEABRASIVE in your plant. See for yourself why Malleabrasive is *guaranteed* to outperform conventional abrasives. The Pangborn Corporation will provide all necessary charts and equipment. Write for free TEST KIT today! Address: PANGBORN CORPORATION, 1400 Pangborn Boulevard, Hagerstown, Maryland.

Use Pangborn's free ABRASIVE ANALYSIS SERVICE!

Pangborn Service Engineers are skilled specialists, backed by Pangborn's 46 years' experience with blast cleaning and as pioneers with metallic abrasives. These men can tell you which size Malleabrasive will save you the most money for your type of work. Ask for a free recommendation. In your letter just tell us what you clean and the type of equipment you use.

Look to Pangborn for the Latest Developments in Blast Cleaning and Dust Control Equipment

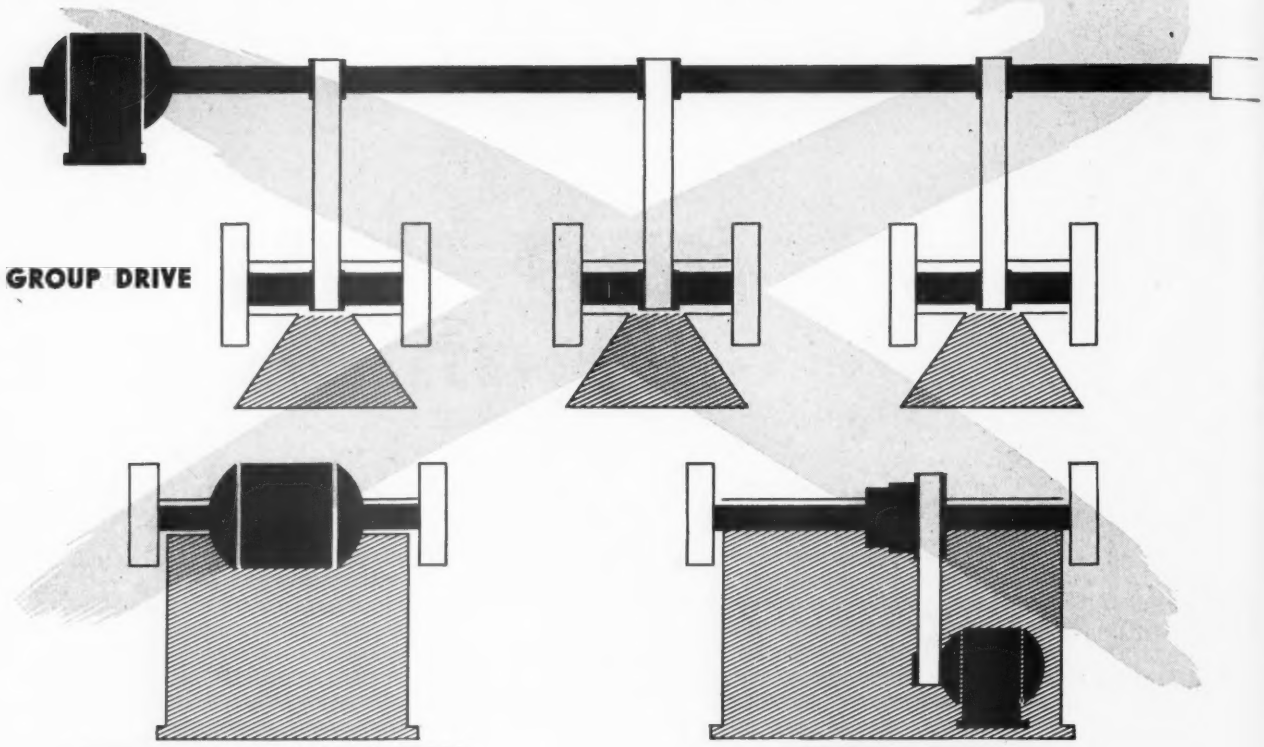
Pangborn

BLAST CLEANS CHEAPER with the right equipment for every job

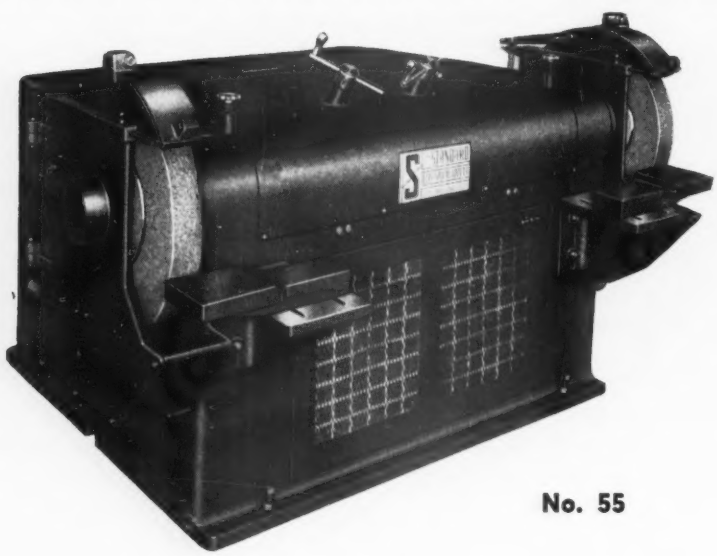
*U. S. Patent #2184926 (other patents pending)

†Names of companies upon request.

WHY PAY FOR INEFFICIENCY?



HERE'S THE WORLD'S MOST MODERN SNAGGING GRINDER



No. 55

STANDARD'S INFINITELY VARIABLE SPEED TWIN-MOTOR SNAGGING GRINDER

INCREASES PRODUCTION 40%!
INCREASES WHEEL LIFE!
LOWERS WHEEL COST!
EACH OPERATOR INDEPENDENT OF THE OTHER!

24″ or 30″ Vitrified or Resinoid Bond Wheels. Twin motors of H.P. selected up to 50 H.P.

The Standard No. 55 is a 2-in-1 machine—each operator is entirely independent of the other; one side may be stationary while the other wheel is operating; one side may be operated with a wheel differing in diameter to the other side, but each wheel operated at its correct and efficient peripheral speed.

SPEED CONTROL: Turn Hand Wheel to adjust **individual** wheel guard as wheel wears and simultaneously increase spindle speed in direct relation to worn wheel diameter, thus maintaining peripheral speed throughout wheel life. Safety interlock prevents overspeeding on grinding wheel.

NOTE: No Tool or Wrenches are required—merely turn the Hand Wheel.

WRITE FOR CATALOG 44 TODAY!

The STANDARD ELECTRICAL TOOL *Co.*

2507 RIVER RD., CINCINNATI 4, OHIO

Yes, you're in good company when you use Smith L-O Core Oil, the oil used and endorsed by many leading foundries throughout the country. Smith L-O is the Dow-Therm processed oil that is tops in uniformity, easily mixed, excellent in workability.

And to assure superior results under your casting conditions, it is available in a wide range of grades to suit the type of sand used and kind of metal cast.

Hit a new high in your core-making production with tested and proved Smith L-O.

Consult our representative in your territory. He is a practical foundryman who may prove helpful when difficult problems arise.

WAREHOUSE STOCKS AVAILABLE
In The Following Cities

- COLUMBIAN WAREHOUSE CO. — Reading, Pennsylvania
- FOUNDRY SERVICE CO. — Birmingham, Alabama
- E. R. FROST CO. — Minneapolis, Minnesota
- F. F. SHORTSLEEVE — Elmira, New York
- MALCOLM G. STEVENS — Arlington, Massachusetts
- PACIFIC GRAPHITE CO., INC. — Los Angeles 22, California
- TERMINAL WAREHOUSE — Worcester 8, Massachusetts
- M. W. WARREN COKE CO. — St. Louis, Missouri
- WESTERN FOUNDRY SAND CO. — Seattle, Washington
- WESTERN INDUSTRIAL SUPPLY CO. — Portland 14, Oregon

Smith L-O Core Oil

ROD DIP LIQUID PARTING

SMITH OIL & REFINING CO.

MANUFACTURERS OF L-O AND CERTIFIED CORE OILS

INDUSTRIAL OILS DIVISION . . . ROCKFORD, ILLINOIS

See you

There will be no foundry exhibit this year, but our representatives will be at the foundry convention and will be pleased to contribute to your after-session entertainment in the Hotel Statler.

Cornell B. Fouse

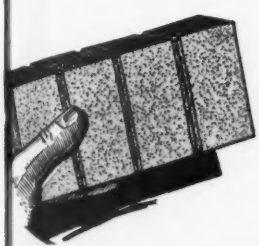
Sec'y-Treas.

famous CORNELL FLUX

in Buffalo

The Key

TO CLEAN METAL AND BETTER CASTINGS IS FAMOUS CORNELL MOLTEN METAL FLUX



FAMOUS CORNELL FLUX IN SCORED BRICK FORM—FOR IRON.

From coast to coast you'll find leading gray iron foundries, and malleable foundries with cupola operation, regular users and strong boosters for Famous Cornell Cupola Flux.

It is their choice because it does a thorough job of cleansing molten iron, makes it hotter and more fluid, reduces sulphur, minimizes casting rejects and machining time, ensures highest efficiency in cupola operation and greatly reduces maintenance. The SCORED BRICK FORM takes but a few seconds and practically no labor to use.

FAMOUS CORNELL FLUX FOR BRASS.

Even when the dirtiest brass turnings or sweepings are used, Famous Cornell Brass Flux cleanses the metal. You will pour clean, strong castings which withstand high pressure tests and take a beautiful finish. The use of this flux saves you considerable tin and other metals, and keeps crucible and furnace linings cleaner, adds to lining life and reduces maintenance.

FAMOUS CORNELL FLUXES
Trade Mark Registered

rite for Bulletins

FAMOUS CORNELL FLUX FOR ALUMINUM.

This flux does a real job of removing impurities from molten aluminum. Even when more scrap is used, you will pour castings that are cleaner and tougher, and amazingly free from spongy or porous spots. You can obtain thinner yet stronger sections, and your castings will take a higher polish. Exclusive formula greatly reduces obnoxious gases, improves working conditions. Dross does not cling to metal after this flux is used.

The CLEVELAND FLUX Company

1026-1040 MAIN AVENUE, N. W., CLEVELAND 13, OHIO

Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes—Since 1918

CHECK THE CONSTRUCTION

The special Shanafelt flange formation adds stiffness and reinforcement, and provides an efficient sandstrip at the parting edges.

Bars in a Shanafelt Flask are always accurately arranged and notched so they fit your patterns without alterations.

Handles and trunnions won't come off. Tensile strength tests of Shanafelt Flasks have shown welds as strong as the steel.

Parting edges are surface ground for an accurate match.

This steel is made to Shanafelt's special formula. It is copper bearing and rust resisting.

Shanafelt hardened steel Bushings and Pins are accurately made to meet the hard requirements of Flask handling.

SHANAFELT builds your steel Flasks any way you want them. Just send your specifications or call for a representative to get immediate estimates of cost, weight and delivery.

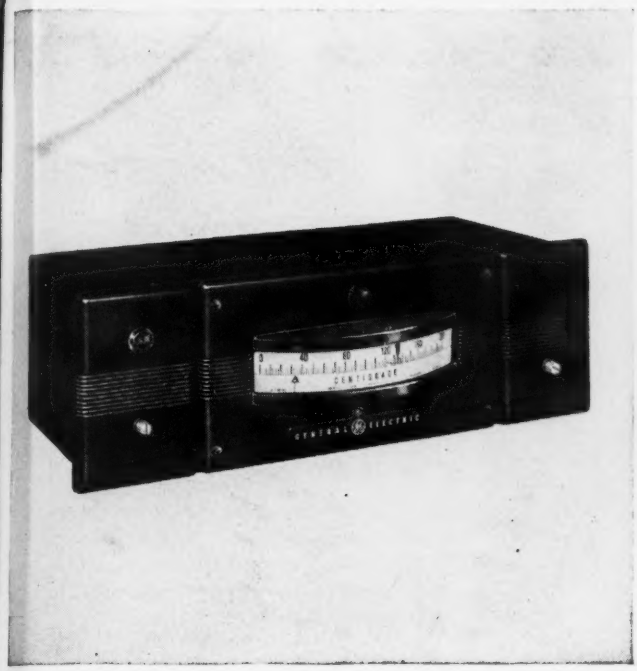
And be sure to use Shanafelt "Seal-Tyte" Chaplets. They've been a dependable, high quality product for 43 years.

The SHANAFELT Manufacturing Co.

ESTABLISHED 1893

2600-2700 WINFIELD WAY N. E. CANTON, OHIO

ACCURATE WITHIN 3/4 OF 1 PER CENT



G-E Type HP-3 pyrometer provides temperature indication and 2-position control of heating apparatus.

Heart of G-E pyrometers: This sturdy indicator assembly has heavy alnico magnet and lightweight armature.

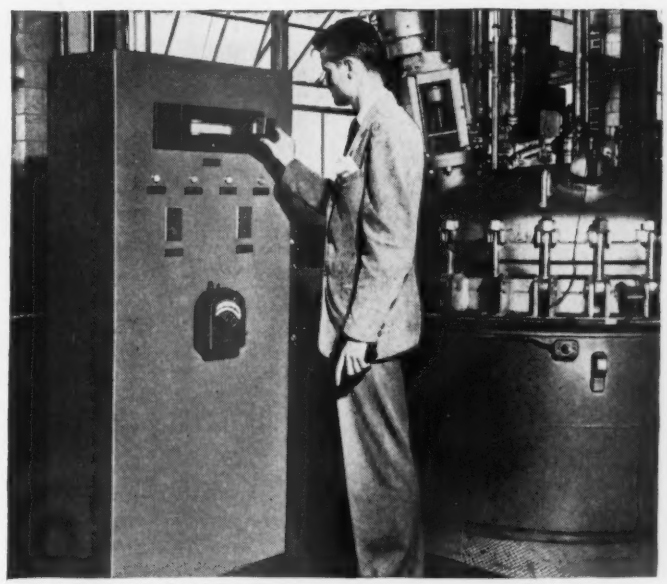
PYROMETER EQUIPMENT

The new G-E pyrometer has an exceptionally high accuracy—3/4 of 1 per cent of full scale. But it also has the ability to hold this accuracy despite shock and vibration. The reason is the inherently sound construction. The instrument has a powerful, heavy (3¼ lb), alnico magnet and a featherweight (one gram) moving coil. This combination (high torque and low weight) results in accurate performance even under the most severe operating conditions.

Other features of this new G-E pyrometer equipment include: Built-in automatic cold-junction compensation that prevents changes in ambient temperature from appreciably affecting performance; gaskets at both base plate and zero-setting mechanism that keep out dirt, dust, and moisture; and an antiglare glass cover fitted over a seven-inch antiparallax scale that makes a G-E pyrometer easy to read.

This new equipment is made in indicating, protecting, and two- and three-position control forms. It is available in a variety of standard temperature ranges in the 0-3000 F span. For complete details, write for Bulletin GEC-713. *General Electric Company, Schenectady, New York.*

Also available: a complete line of thermocouples.



Control unit of HP-3 pyrometer being inspected. The HP-3 is used here with a compound vacuum-treating tank.

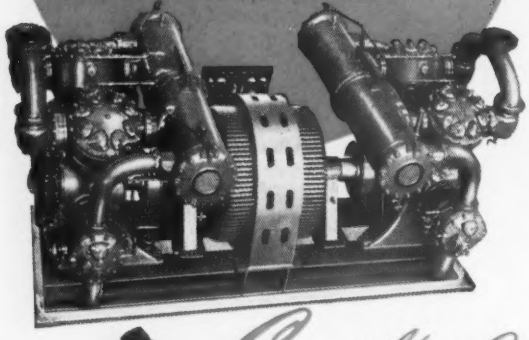
GENERAL ELECTRIC

602-204

Get TROUBLE-FREE AIR POWER at ROCK-BOTTOM COST!

JOY Series 100 compressors are available in two and four cylinder models and in single and twin units. Capacities from 378 to 3656 c.f.m.

UP TO 3656 C.F.M. in a TWIN!



with a JOY PACKAGE TYPE HEAVY DUTY WN-114 COMPRESSOR

Install it, start it,—then forget it! That's what you can do with a JOY compressed-air power unit, because it's built to give constant, dependable service 24 hours a day, year in and year out. JOY Series 100 Air Compressors are two-stage, double-acting, heavy duty, continuous service compressors—much smaller than old style compressors of the same capacity, yet with operating economies exceeding those of the older, bulkier units. JOY *pioneered* the compact, modern, "package-type" compressor.

All wearing parts are replaceable on the Series 100—the finest air compressors you can put on the job. ● *Let us give you full details on the size that fits your air-power requirements.*

Consult a Joy Engineer

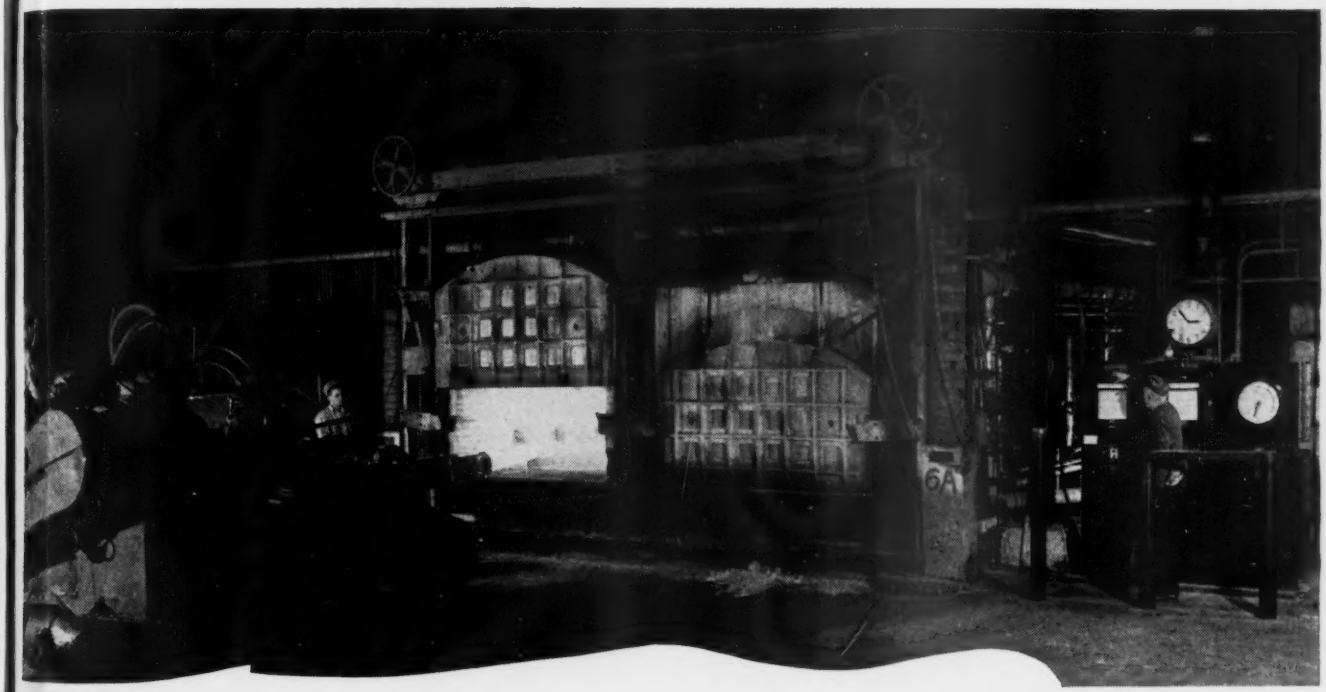
100 Years of Engineering Leadership

W&D I 3513

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO



This New Controller Says "Hurry Up, Furnace!"

WITH production reaching toward all-time highs, this new P.A.T. 50 Control already is helping many key plants increase the output of their furnaces. Here's why:

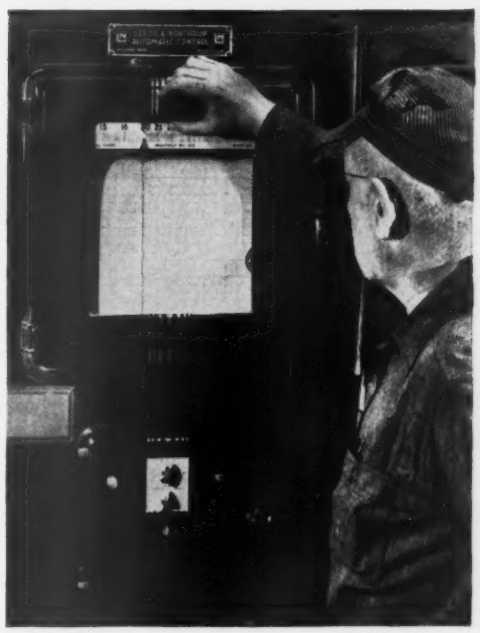
This Control has something that's brand new in proportional, electric controllers. Called "rate action," this feature enables the Controller to act on the *speed* of swings in furnace load, as well as on their size and on the length of time they persist. Thus, if temperature changes gently, it is gently nudged back into line. But if it starts off vigorously—as when the furnace door is opened—P.A.T. 50 reacts vigorously. Then, when the change has been headed off, the Controller starts to back away. But "putting on the brakes" it brings temperature in line smoothly and rapidly.

Thus, "Rate Action" increases production because it reduces the length of time a furnace is off temperature.

Also, Proportioning and Reset Actions are more responsive than before. These two components stop the normal temperature swings which are started by changes in the size and permanence of the furnace load. Even without rate action, these increases would enable P.A.T. 50 to do a better-than-ever job. With rate action, results are superior to any previous electric control.

The News is in the Control Unit at bottom of panel shown at right. Earlier installations can be converted to P.A.T. 50 by replacing the Unit and making slight changes in the Controller.

For details, contact our nearest office, or write us at 4917 Stenton Ave., Philadelphia 44, Pa.



THESE furnaces and controllers are part of the slab-heating equipment with which The Timken Roller Bearing Company, Canton, O., conditions high-alloy steels for rolling. The Timken Company has used many earlier L&N Controllers. They find P.A.T. 50 is a further step forward, not only in guarding quality, but also in increasing production by shortening the off-temperature time.

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

Pet. Ad ND4-660(1)

SPEEDY ROTOR CHIPPERS "PAID OFF" in 29 days

JOB: Cleaning off excess metal from base plate castings for printing presses. Men on incentive. Rigid inspection. Were using 14¾-lb. hammers—slow and hard to control.

SOLUTION: Rotor Application Engineer recommended new Rotor Chipper. Weighs only 11½ lbs. Easy to maneuver. High speed. Lots of wallop.

RESULTS: Cut rejects. More output per day "paid off" new Rotor Chipper in 29 days.

Unusual? Not at all! We believe we can get similar results in your plant. Call us for a survey.

ROTOR CHIPPER FACTS

LIGHTER . . . 1½ to 3 lbs. less than other chippers.

SHORTER . . . 1″ to 2″ shorter . . . easier to get into crowded corners.

MATCH YOUR JOB . . . Each basic model can be adapted to three kinds of work.

AIR O'TOOL

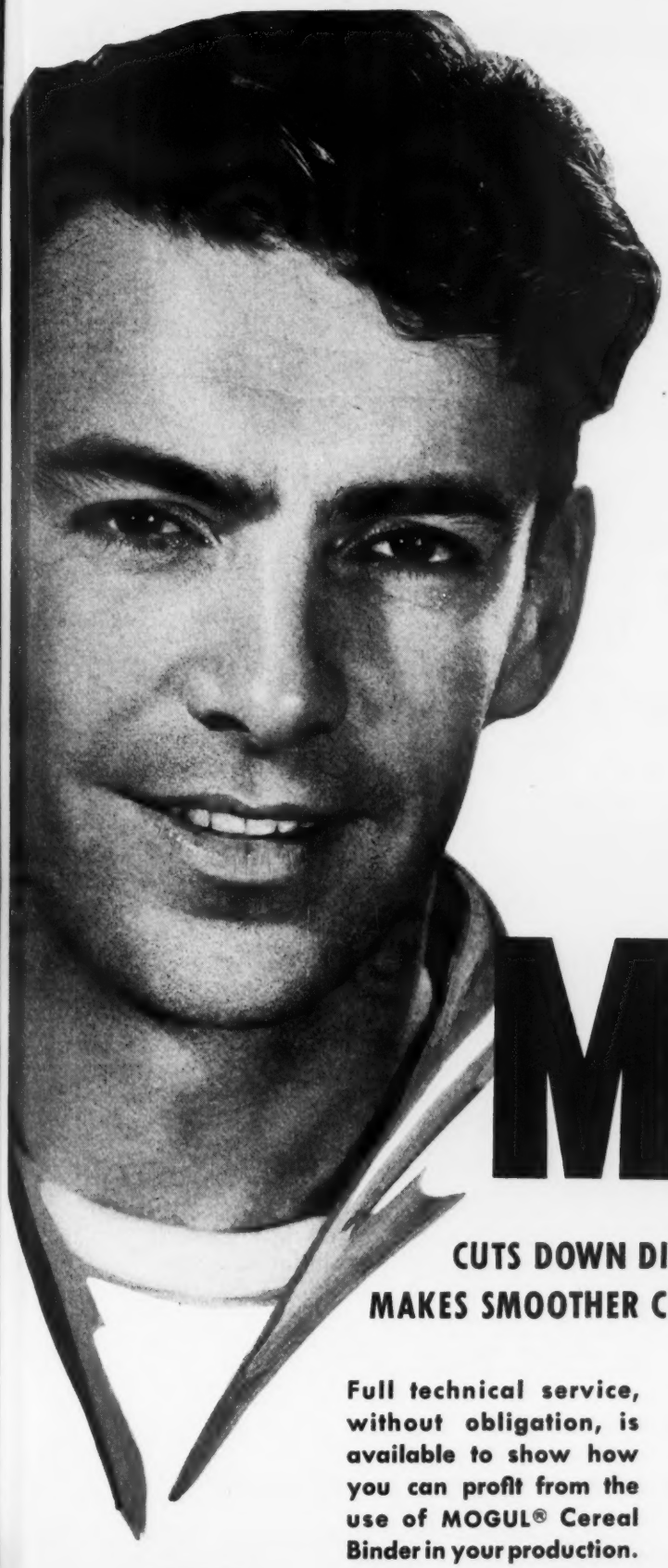
AIR

THE ROTOR TOOL CO.

CLEVELAND, OHIO

HIGH CYCLE

UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS



You can cut down drying time with MOGUL

CUTS DOWN DISCARDS
MAKES SMOOTHER CORES

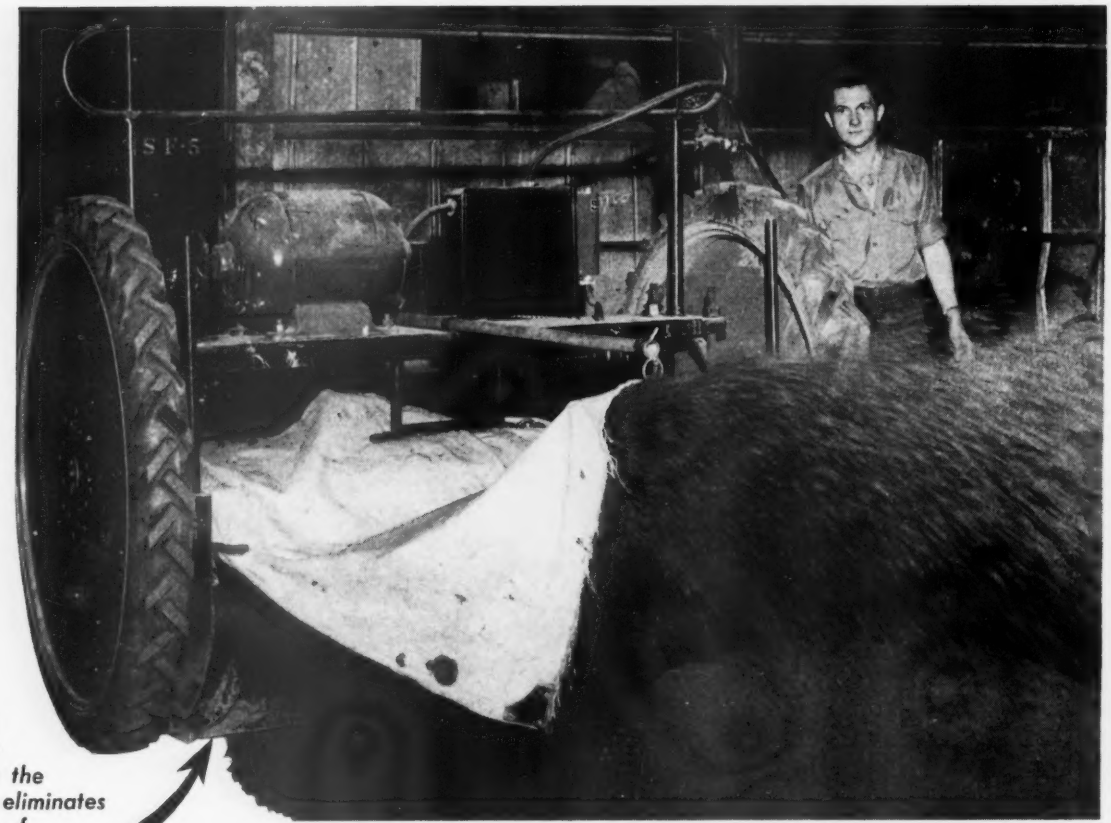
Full technical service, without obligation, is available to show how you can profit from the use of MOGUL® Cereal Binder in your production.

the preferred dry bond for cores

Write Technical Sales Department

CORN PRODUCTS REFINING COMPANY
17 Battery Place, New York 4, N. Y.

DO YOU NEED THOROUGHLY CONDITIONED SAND TO MAKE BETTER CASTINGS?



This drag scoops the sand from the floor and eliminates any layer of unconditioned sand

This Moulders' Friend was rolled off a truck on to the floor of a North Carolina foundry where it conditioned all of the moulding sand without any rearrangement of the heaps. The Moulders' Friend will fit your foundry too.

THE MOULDER'S FRIEND GIVES YOU THOROUGHLY CONDITIONED SAND

The thousands of flat tempered steel wires in the brush revolving at high speed pick up small particles of used sand, added bond and moisture and blend them thoroughly. This process is so thorough that either clay bond or new moulding sand is blended with the heap successfully and a minimum of moisture is required.

THE BRUSH DOES THE JOB

●

THE MOULDER'S FRIEND SAVES MONEY . . .

capacity over one ton per minute—one man operation—simple construction—easy to buy and use—pays for itself with better castings and less labor.

Investigate The Moulders' Friend today. See one in operation.

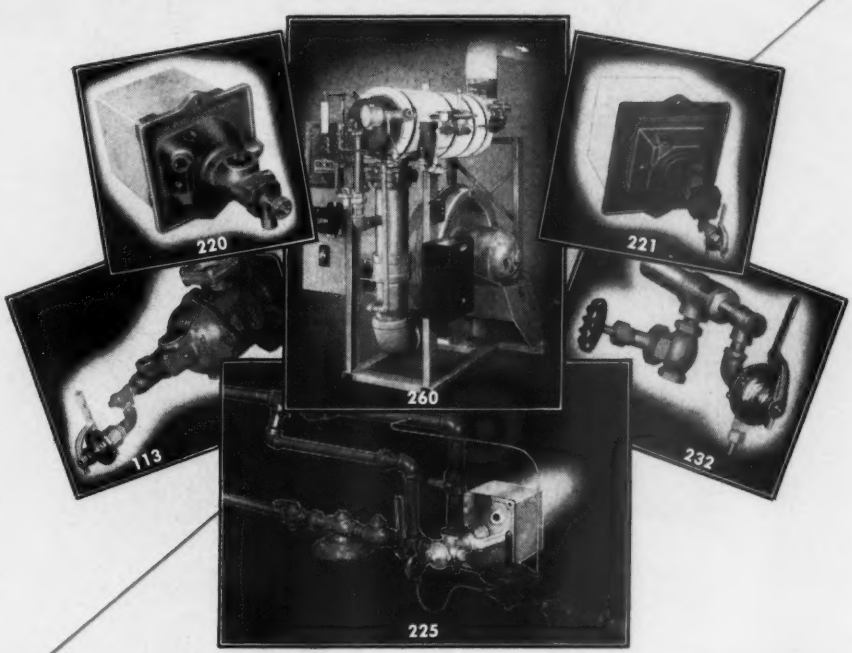
"The Moulders' Friend"
Dallas City, Illinois

Peak Efficiency **either** *Gas or Oil*

with

North American

Dual-Fuel Burners*



THE LINE IS *Complete*.....SELECT

THE BURNER YOUR OPERATING CONDITIONS REQUIRE

113—Long Flames. **220-221**—Short Flames, sealed-in mountings. **225**—For rugged duty, open or closed mounting, gas at zero. **232**—Compressed air atomizing oil inserts. **260**—Oiltogas Converter for burning oil as a gas in existing gas burners.

*Dual-Fuel: The North American name for burners designed especially for both gas and oil. Fuel changed by merely turning valves.

THE NORTH AMERICAN MANUFACTURING COMPANY

MANUFACTURERS OF INDUSTRIAL FUEL BURNING EQUIPMENT FOR GAS OR OIL

BRANCH OFFICES *with* FIELD ENGINEERS *in* PRINCIPAL CITIES

CLEVELAND 5, OHIO

THIS MONTH, 62,562* BUYERS OF CASTINGS WILL READ THIS AD...

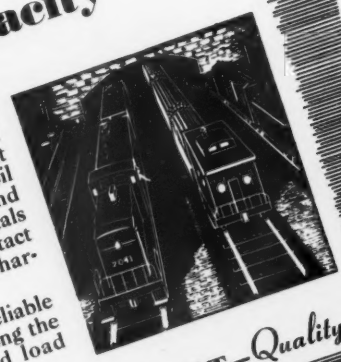
This is one of a series of 6 full page ads emphasizing the expanding industrial acceptance of Brass Castings. Nationally circulated in outstanding trade journals and read by manufacturers, engineers, contractors, metallurgists, production control men—*these messages reach the men who specify and influence the purchasing of castings!*

R. Lavin & Sons, Inc.

* Audited Circulation plus pass-on readership.

RAILROAD DESIGNERS KNOW...

Bronze Journal Bearings Have Highest Fatigue Strength and Load Carrying Capacity



Performance of railroad journal bearings, under heavy load applications at relatively low speeds, can not be anticipated by the usual physical tests of tensile strength, elongation, etc. Since it is impossible to maintain a perfect oil film between the rotating journal and bearing, the behavior of bearing metals under momentary *metal-to-metal* contact becomes a major distinguishing characteristic.

With proper shaft alignment and reliable lubrication, bronze alloys are among the highest in fatigue strength and load carrying capacity.

Specify—LAVIN NON-FERROUS INGOT—*Quality*

R. LAVIN & SONS, INC.

Refiners of Brass, Bronze and Aluminum

3426 SOUTH KEDZIE AVENUE · CHICAGO 23, ILLINOIS

REPRESENTATIVES IN PRINCIPAL CITIES

REPRINTS OF ENTIRE *Brass Castings* SERIES ARE YOURS FOR THE ASKING

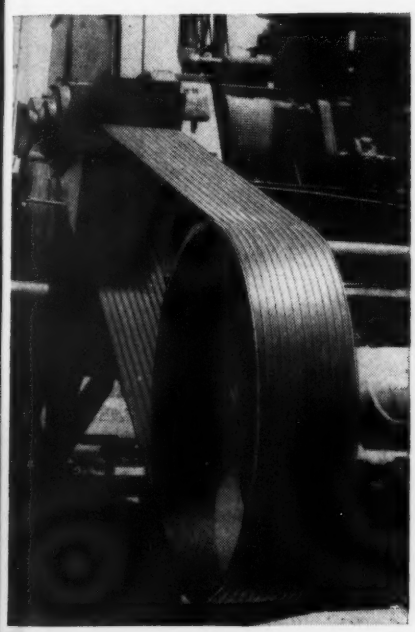
The Foundryman's Problems . . . Are Our Problems!

BWH

DEPENDABLE RUGGEDNESS

This 73 Years of "Majoring" in Mechanical Rubber Goods

CAN CUT YOUR V-BELT MAINTENANCE COSTS



Back of the 4 big construction reasons why Bull Dog V-Belts give you maximum dollar's worth for your V-Belt money in longer service life, less slippage and headache-free operation, you'll find a history of 73 years of BWH leadership and specialization in industrial rubber goods. Constant research by BWH technologists has produced the following noteworthy "firsts" for the rubber industry: circular woven fire hose . . . the alkali method of rubber reclaiming . . . the oxygen bomb for pretesting rubber goods . . . continuous vulcanization . . . air separation of rubber from cotton in cured rubber scrap.

The BWH know-how that produced these contributions brings you V-Belts with:—

1. Specially Engineered BWH Cord Section for high tensile strength. This provides superior load carrying capacity plus ability to absorb shock loads.
2. Minimum Stretch — due to a new and exclusive technique in processing Bull Dog Cords. This assures less slippage, fewer adjustments, longer belt life.
3. Durable Covers — closely woven, heavy, bias-cut fabric takes the severe wearing action where the belt contacts the sheave — seals belt against penetration of dirt, grease, moisture.
4. Ability to Take Punishing Flexing. BWH quality-controlled compounds run cooler and do not crack or deteriorate under severe flexing.

For these reasons it will pay *you* to put a set of Bull Dog V-Belts to work and see for yourself how they pay off. Your BWH distributor can supply you.

TOUGH PROBLEMS INVITED—Don't hesitate to ask us or your nearest BWH distributor about your transmission belting, conveyor belting and hose problems. We're specialists in making mechanical rubber products work *better, longer.*

Another Quality Product of

BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in all Principal Cities

PLANT: CAMBRIDGE, MASS. • P. O. BOX 1071, BOSTON 3, MASS., U. S. A.

IT'S FANNER for CHAPLETS

is the finest chaplet ever developed

FANNER *GROOVESTEM* CHAPLET

THREE EXCLUSIVE FEATURES

1 FEATHEREDGE FUSION RINGS

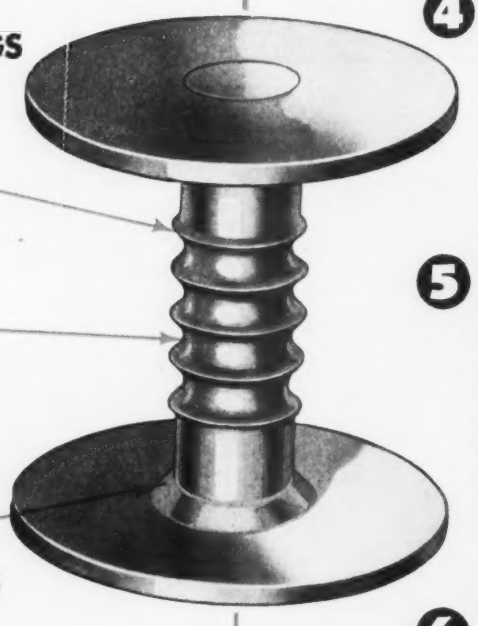
Knife-like edges on the multiple rings heat instantaneously to fusion temperature — completely sealing chaplet into casting and eliminating leakers.

2 COMPLETE CONTACT RADIUS GROOVES

Molten metal rolls up solidly against the rounded bases of the radius grooves. Greater chaplet area contact results in maximum fusion. No sharp angles to trap gases or weaken stem strength.

3 COUNTERSUNK SHOULDERS

Heavy, tapered shoulders provide solid support to plates — allow full contact with molten metal. No sharp angles to create voids usually formed under heads of ordinary chaplets.



Plus THESE ADDED STANDARD FEATURES

4 FULL STRENGTH

Reinforced construction at all required points provides maximum support without use of extra heavy metal.

5 PURE TIN COATING

The surest protection against rust, as well as aid to fusion. Readily alloys with iron and steel, lowering melting point and improving fusion. Also available in pure copper.

6 PRECISION TOLERANCES

Held to ±.002 on most sizes, Fanner reputation for accuracy is unequalled.

HERE IS WHY THESE FEATURES MEAN BETTER CASTINGS FOR YOU!

1. *Assured core support*
2. *Maximum fusion*
3. *Freedom from leakers*
4. *Accurate wall thicknesses*

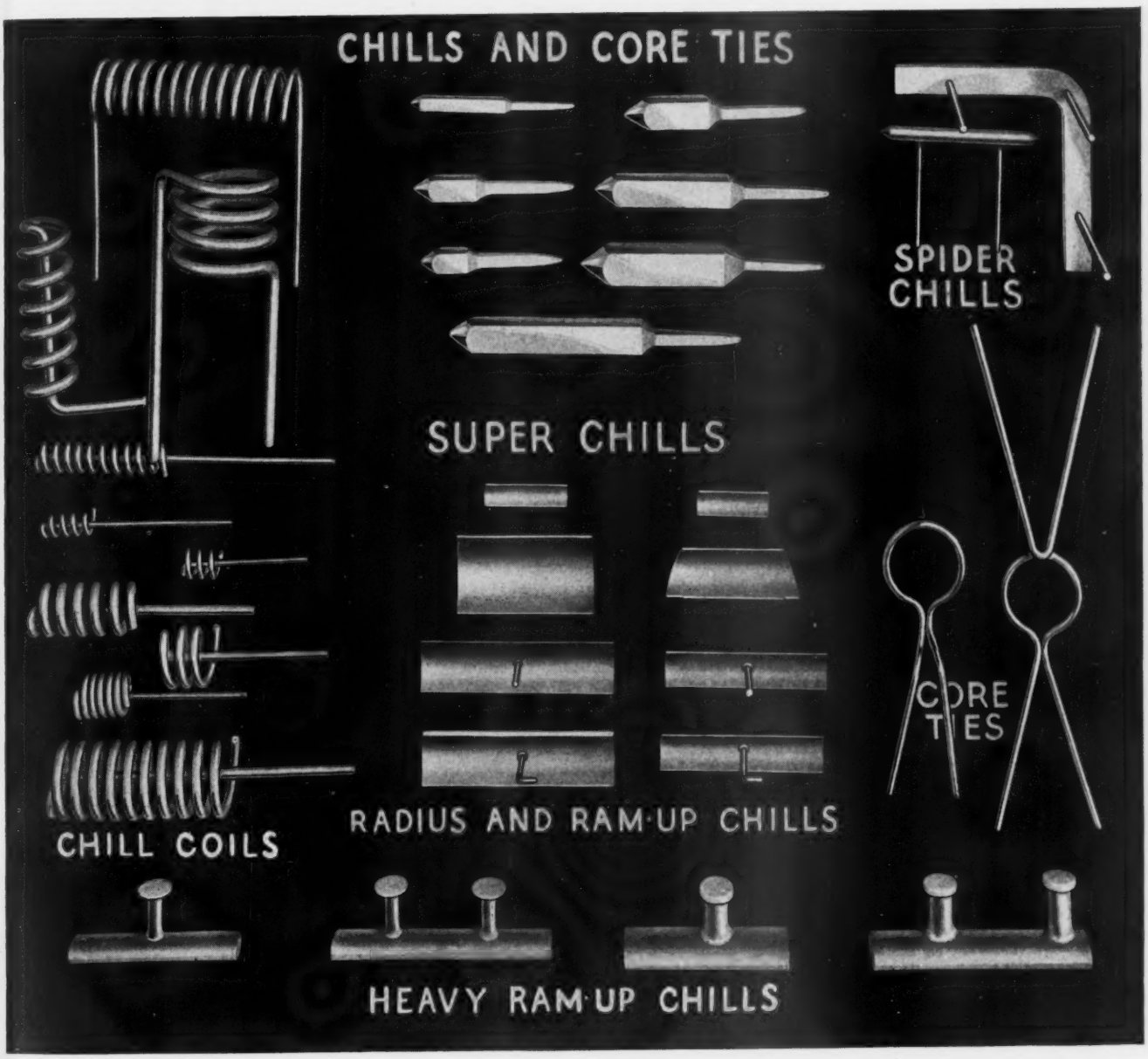
THE FANNER MANUFACTURING CO.

In Canada: CANADIAN

IT'S FANNER for CHILLS

FANNER *Chills*

MADE IN A WIDE VARIETY OF TYPES AND SIZES TO MEET YOUR SPECIFIC CHILL PROBLEM



Fanner Manufacturing Company is the world's largest manufacturer of chills and core ties used primarily in steel foundries. Designed for ramming up in the pattern or for placement after molding, a complete line of chills to meet all shrink problems has been developed by Fanner engineering. Available black, or in copper or tin coatings. Write for Fanner Chill Catalog which includes complete description and prices.

BROOKSIDE PARK, CLEVELAND 1, OHIO

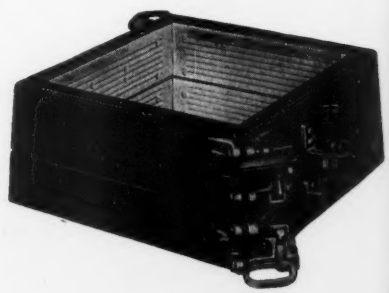
FANNER LTD., HAMILTON, ONT., CANADA

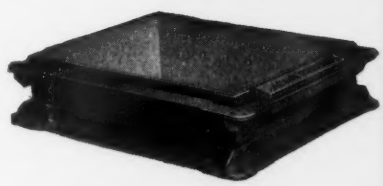
Partners in Production

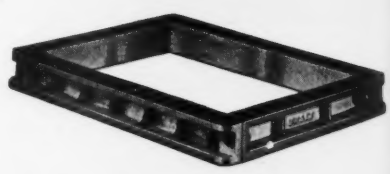
Adams 12"-38"
Jolt Squeezer
Portable Type

ADAMS

MOLDING MACHINES and CUSTOM-BUILT FLASK EQUIPMENT







HERE are the "Partners" that keep production rolling and costs low . . . help you meet today's increasing competition with *faster* production of *better* castings at lower cost.

Adams Molding Machines are designed by experienced foundrymen to solve your production problems . . . to give you the speed, power and durability for consistently large output day after day. Close control of jolting and squeezing operations means accurate, uniform molds. Smooth, easy operation, with minimum working parts, simplifies operation and maintains steady, high output levels.

Adams Flasks are custom built to your exact specifications for superior performance and economical production.

Get these "Partners" on your production team now! Write for full information. THE ADAMS COMPANY, 700 Foster Street, Dubuque, Iowa.

The ADAMS Company

ESTABLISHED 1883

MOLDING MACHINES and FLASK EQUIPMENT

DUBUQUE, IOWA, U.S.A.

How to Improve Parting at any Foundry Temperature

Use **"dag"** colloidal graphite dispersions. They work at any temperature to be met in the foundry . . . even up to 5000° F. in inert atmospheres.

Colloidal graphite, when applied to molds, chills and patterns, produces an unusually slippery dry film because of its peculiar arrangement of atoms. Parting is made easy and the film is so thin that critical casting tolerances are not affected at all.

Molds and patterns so treated give superior reproduction and smoother casting surfaces. Less finishing is required, often none at all. Rejects are fewer and inspection takes less time. Mold life is lengthened.

"Dag" dispersions can be used, too, for lubrication of flask pins, shoulder screws and push pins. They eliminate binding and stripping, an important saving in time and money.

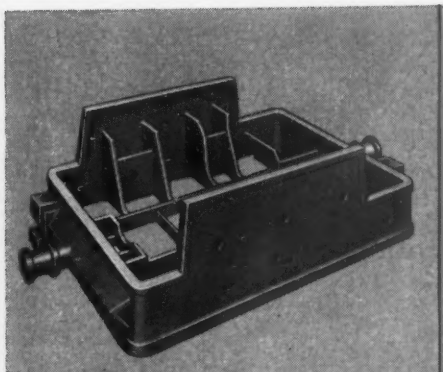
"Dag" water dispersions also eliminate or reduce the choking fumes and smoke usually caused by conventional petroleum-base parting compounds, thus improving shop conditions.

The use of **"dag"** colloidal graphite in the foundry is explained fully in a new bulletin that is available without obligation. Write today to Acheson Colloids Corporation, Port Huron, Michigan, for your copy of Bulletin #425-14D.

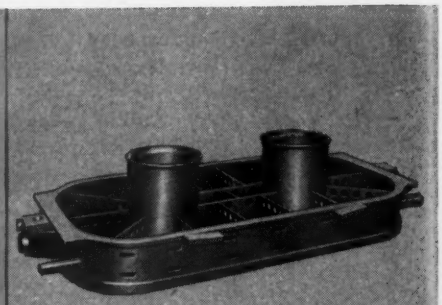
dag
DISPERSIONS®

Acheson Colloids Corporation
Port Huron, Michigan
. . . also Acheson Colloids Limited, London, England

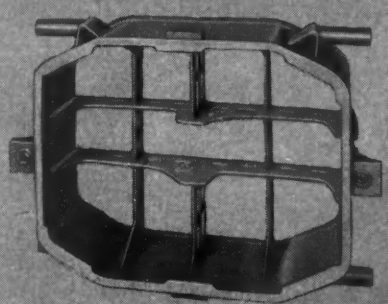
TYPICAL *Industrial* Standard Fabricated Flasks



Foundry efficiency demands unusual shapes and sizes for economical production



Cut-Away Cylinder Block Flask



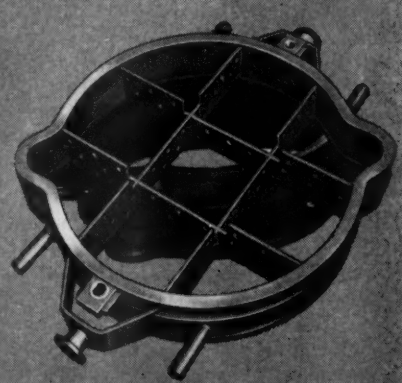
Twin Stack Converter Housing Roll-Off Flask

"A" Type Tool Base Flask

Octagon Shaped Flask

Industrial is equipped to engineer and build fabricated flasks to your standard and special requirements.

Round Wheel Flask with Pouring Lips



Special Flasks at Standard Prices

Write for our Catalog

I.F.I.

INDUSTRIAL FABRICATING, INC.

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In Canada: Don Barnes, Foundry Supplies & Equipment, 42 James Street South, Hamilton, Ontario

USE TRULINE® BINDER TO

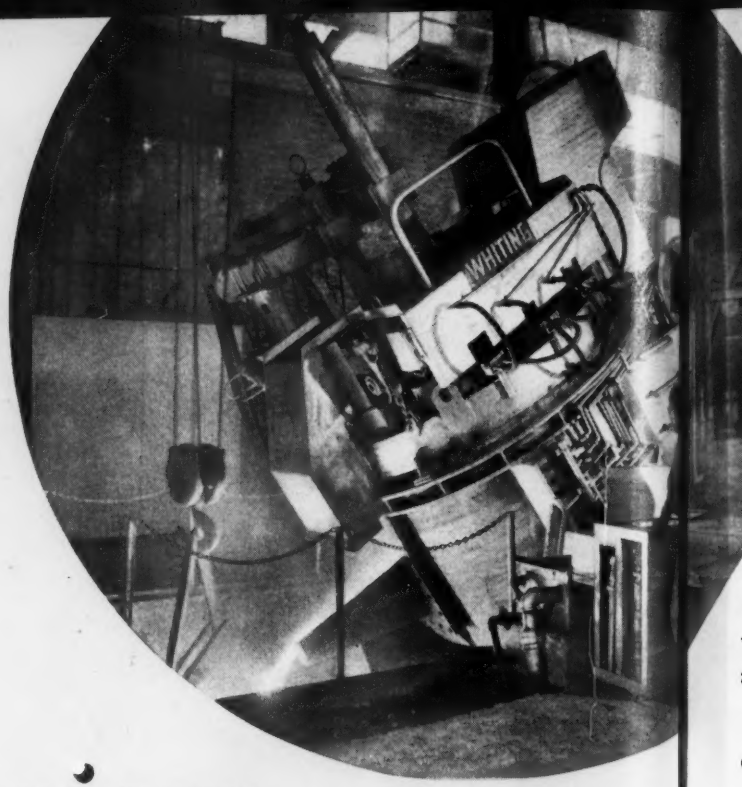
Cut Shake-Out Costs

"Truline" Binder in your core mixes cuts cleaning time and costs because "Truline"-bonded cores burn out quickly, collapse easily, and shake out fast. Many foundries report "Truline" saves up to 50% in cleaning time. And castings come out cleaner, require less finishing.

"Truline" cuts core baking time, too . . . speeds baking cycles in conveyor-type ovens. Many other ways in which this Hercules resin binder can save time and money in iron and steel foundries are included in a technical booklet. Send for your copy.

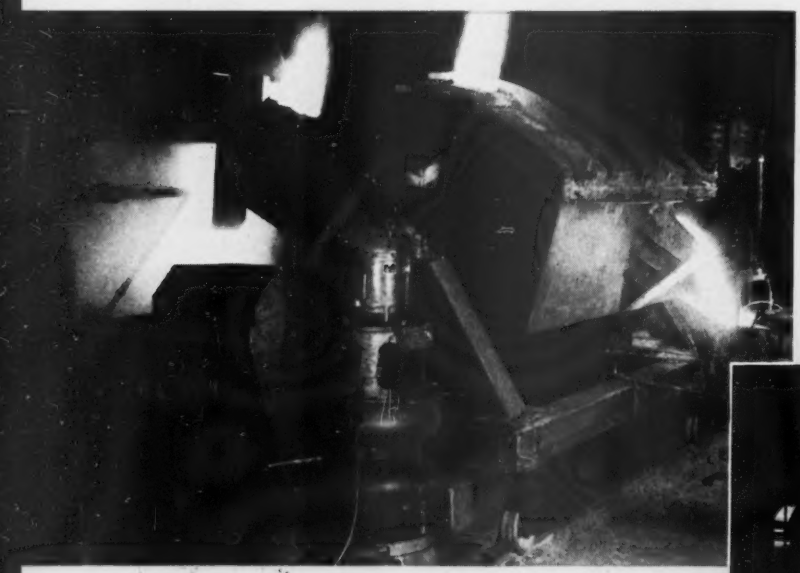
HERCULES POWDER COMPANY 920 King St., Wilmington, Del.

NF51-2

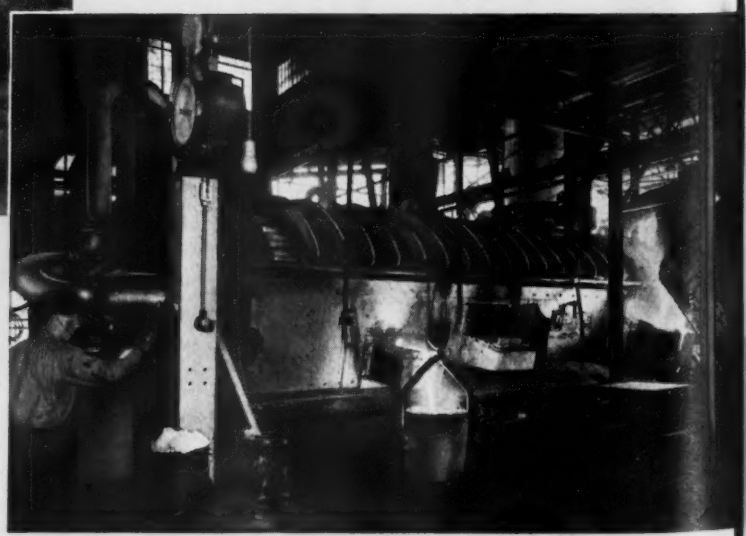


Whiting Hydro-Arc Electric Furnaces operate at such low cost that they are coming into wide use for foundry melting—either alone or in duplex combination with cupolas.

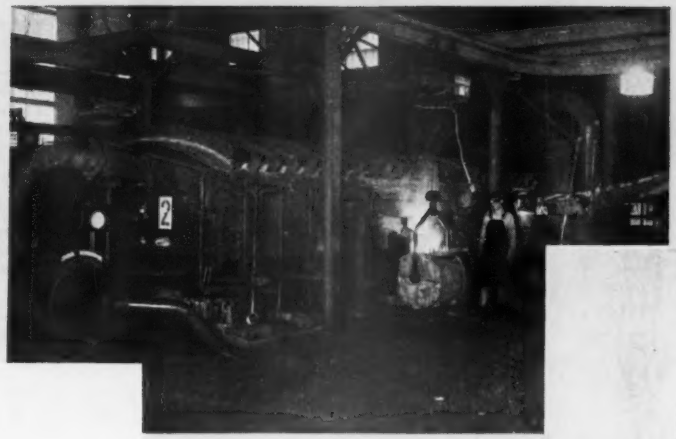
HOW 60 Years Experience IN MELTING LEADS TO BETTER EQUIPMENT AND PRACTICE



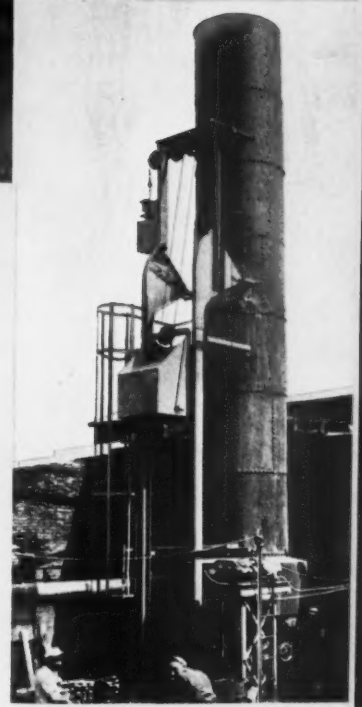
The Whiting Heated Metal Mixer is used in combination with a cupola to hold composition uniform and keep metal at pouring temperature. Fired with pulverized coal or oil. Excellent for light, thin-sectioned castings.



Whiting Cradle Furnace is recommended chiefly as a holding furnace to supply homogenous super-heated metal for continuous pouring. Can be fired with either pulverized coal or oil.



Duplexing combines two melting units to make use of the best advantages of each. Shown here is cupola-to-air furnace combination for malleable iron. Cupola-to-electric furnace is also a favored duplexing combination.



Basic melting unit for gray iron is the cupola. Whiting Cupolas do the melting for over 90% of all gray iron castings produced in the United States.

In selecting melting equipment there are two basic considerations to be taken into account: 1) Will it provide metal of the desired analysis and temperature? 2) Will it provide this metal at the lowest cost per ton?

The type of equipment which will provide the best answers to these questions depends on metal specifications, size and section of castings, daily tonnage requirements, and many other factors.

In metallurgy there is no substitute for experience, or for know-how in designing metallurgical equipment. Since 1884 Whiting has built foundry melting equipment. From today's complete Whiting line, foundry engineers can recommend without bias the best unit or combination of units for your operations.

It will pay you to consult Whiting foundry engineers when plans are *first* considered.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

WHITING CORPORATION

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Offices in Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, and Seattle. Representatives in other principal cities. Canadian Subsidiary: Whiting Corporation (Canada) Ltd., Toronto, Ontario. Export Department: 30 Church St., New York 7, N. Y.

This ventilated-bottom air furnace delivers 12½ tons of metal per hour. Here it is being tapped into a cylindrical ladle. Note that it is fired with pulverized coal.

NEED INCREASED PRODUCTION?

ADD EXPERIENCED KNIGHT ENGINEERS TO YOUR STAFF

— for temporary service

KNIGHT SERVICES for FOUNDRIES

- PLANT LAYOUT
- ARCHITECTURAL PLANNING
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- MODERNIZATION
- MECHANIZATION
- MATERIALS HANDLING
- MANAGEMENT
- ORGANIZATION
- PRODUCTION AND COST CONTROL
- JOB EVALUATION AND WAGE INCENTIVES
- FOREMAN TRAINING

WHAT DO YOU NEED to improve your foundry's production and cost picture for the busy days ahead — better layout? — facilities? — methods? — wage incentive? — procedures? — organization? Whatever the problem, Knight Engineers are available to survey your operations to establish a self-amortizing program of improvement and work closely with your staff to carry it out successfully.

Possibly your plant needs revision or expansion — or you need a complete new foundry. Knight can be of unusual service here, too, with a staff of experienced architects and structural engineers.

One thing to remember — the Knight organization is no stranger to your type of foundry and its particular operations, for Knight Engineers have had from 10 to 30 years of successful foundry management, production, engineering or equipment experience in all types of foundries — grey iron, steel, malleable, cast armor, magnesium, aluminum, brass and bronze — and in foundries as applied to automotive parts, farm implements, aircraft, ordnance, machine tools, electrical equipment and many others.

Now is the time to investigate the advantages of a modernization program for your foundry. Call or write our New York or Chicago office for immediate attention.

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CONSULTING SERVICE: Management, Sales, Production — ENGINEERING SERVICE: Surveys, Modernization, Mechanization
PLANT AND ARCHITECTURAL ENGINEERING

Mixes, tempers foundry sand with the help of TIMKEN® bearings

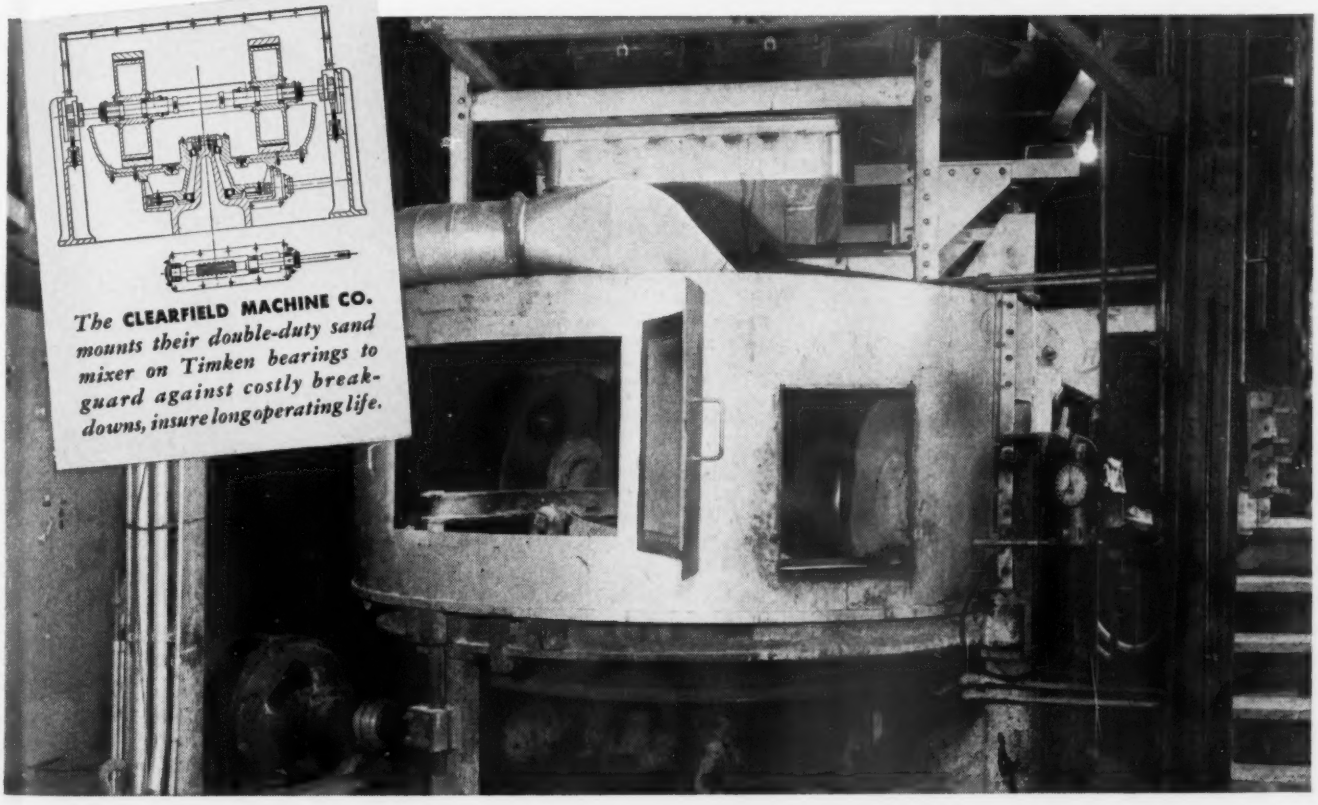
CLEARFIELD Sand Mixers do two jobs at once! They mix and temper foundry sand at the rate of a ton and a half per minute! It's a tough, grueling job, but the Clearfield Machine Company have made certain their mixers can take long years of hard service by mounting them on Timken® bearings. For instance, the mixer shown in the photo below was first put into operation in 1936—fourteen years ago—at a foundry in the Pittsburgh district. Today, in 1951, it's still going strong—thanks to the original Timken bearings. With Timken bearings used on the pan, muller wheels and unloading disc, breakdowns have been prevented, maintenance minimized, trouble-free operation assured.

Timken bearings take radial and thrust loads in any combination. Line contact between rollers and races provides maximum load-carrying capacity. Shafts are held in positive alignment, reducing wear on surrounding parts. Manufactured to extreme precision and finished to incredible smoothness, Timken bearings make friction negligible. And highly important in foundry sand applications, Timken bearings permit tight, lubricant-retaining closures. Grit and moisture are kept out and the lubricant is kept in. Maintenance time and costs are cut to a minimum.

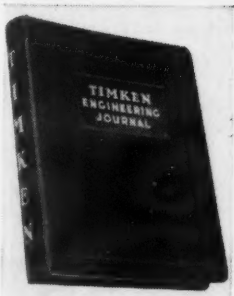
Under normal conditions, Timken bearings last the life of the machine in which they're used. That's because (1) they are engineered for the job, (2) they are made of Timken fine alloy steel, and (3) they are precision manufactured.

No other bearing can give you all the advantages you get with Timken bearings. They have 50 years of bearing research and development behind them. Be sure to specify bearings with the trade-mark "Timken" in all the machines you build or buy. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best



The **CLEARFIELD MACHINE CO.** *mounts their double-duty sand mixer on Timken bearings to guard against costly breakdowns, insure long operating life.*



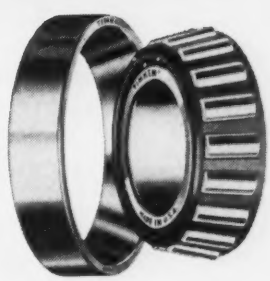
NEW ENGINEERING JOURNAL!

529 PAGES! Includes new, technical information on bearing applications available nowhere else. Especially helpful to design engineers. Gives bearing dimensions, capacities, selection and mounting data. For a copy, write on your company letterhead to The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

TRADE-MARK REG. U.S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ⬯ AND THRUST →⬯← LOADS OR ANY COMBINATION →✳←

when you need CORE BOX PROTECTION ...it's MARTIN

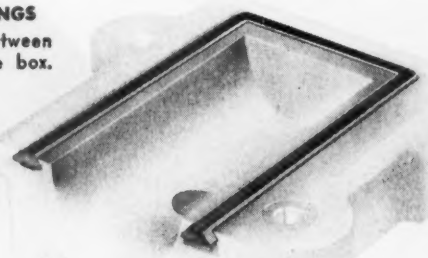
Every Martin product is designed especially for "core box protection"—each is built to prevent a specific type of wear on your core boxes. They are engineered by foundry men to assure easy installation, successful operation. Martin products add years to the life of your equipment by enabling you to salvage old plates and core boxes, by preventing abrasion, and giving your plywood blow plates the lasting qualities of steel. Each product carries a guarantee of absolute satisfaction. Martin products are distributed all over the world by foundry supply houses.

"PROTEXABOX PINS"
Cannot mar the box face because they will not loosen. Protective rubber tip guaranteed to stay on.

"SAND ARRESTER TUBE"
Save cores and step up production. Guaranteed for 100,000 blows.

"HOLINER" BUSHINGS
Stop abrasion between blow plate and core box. Protect blow holes.

"PULLINSERT" BLOW BUTTONS
Positively stop sand blasting under blow holes. Available in nine popular sizes.



"STRIPINSERT"
Protects parting line—easily installed in old or new boxes. Cutters for groove available at moderate cost.

"VIBROLATOR"

The powerful all-directional vibration of the Peterson Vibrolator makes this an ideal unit for keeping materials flowing in chutes or hoppers. The Vibrolator will not crack attaching lugs on match plates or core boxes. Instantly self starting and virtually noiseless in operation, this new type vibrator eliminates maintenance worries and gives a long, dependable service life. No lubrication is necessary. The Vibrolator is light in weight to lessen fatigue and permit maximum delivery of vibration. There are five sizes available to meet all your foundry requirements. Peterson Vibrolators are sold only by Martin, exclusive manufacturers of ball-type vibrators.

"VIBROLATOR"

WRITE for folders describing these Martin products in detail. If you have a sand movement problem, send us complete information and our engineers will prescribe the correct vibrator for your needs.

MARTIN ENGINEERING COMPANY
KEWANEE, ILLINOIS

THE AMERICAN MONORAIL COMPANY

13104 ATHENS AVENUE CLEVELAND 7, OHIO

Floatex® Does It for Farrel-Birmingham

That jumbo casting is a pump casing of GA Meehanite® metal weighing over four tons. It is about to shed its cement "overcoat" in the Ansonia, Conn., plant of Farrel-Birmingham Company, Inc.

It's unique for two reasons—it was cast with cement-bonded sand . . . and that sand will be removed in ten minutes!

A Hewitt-Robins Floatex Shakeout does the trick. With an air gun, it used to take up to 15 hours!

Flasks like this are routine for the Floatex Shakeout, and there's good reason why . . . it's *designed* right and it's *built* right. Floatex is big, it's fast, yet it's gentle. It does the job by shaking the *flask*—not the foundry.

The live frame is supported by soft, heavy duty coil springs. Vibration can't escape to weaken building structures, collapse unpoured molds or jangle workers' nerves. And every inch of the Floatex deck vibrates . . . *every inch is alive.*

What's more, Floatex can do not *one* but *two* basic foundry jobs . . . flask shakeout and core knockout . . . in a single operation without removing the casting! That means only *one* investment, and twice the work from the same machine.

Hewitt-Robins Floatex Shakeouts are made in portable, stationary and self-discharging types—in sizes to handle flasks weighing a few ounces up to 100 tons and more.

Write today for Bulletin 124B. It tells the whole story. Robins Conveyors Division, 270 Passaic Avenue, Passaic, N. J.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

HEWITT-ROBINS

FLOATEX SHAKEOUT

HEWITT-ROBINS HR INCORPORATED

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A name to remember!

Nichols

Sand Reclamation Systems

SAVE . . . on Costs

SAVE . . . on Space

SAVE . . . on Used Sand Disposal

Reclaiming foundry sand with a Nichols Sand Reclamation System is to have sand when you want it —where you want it—and at a very low cost.

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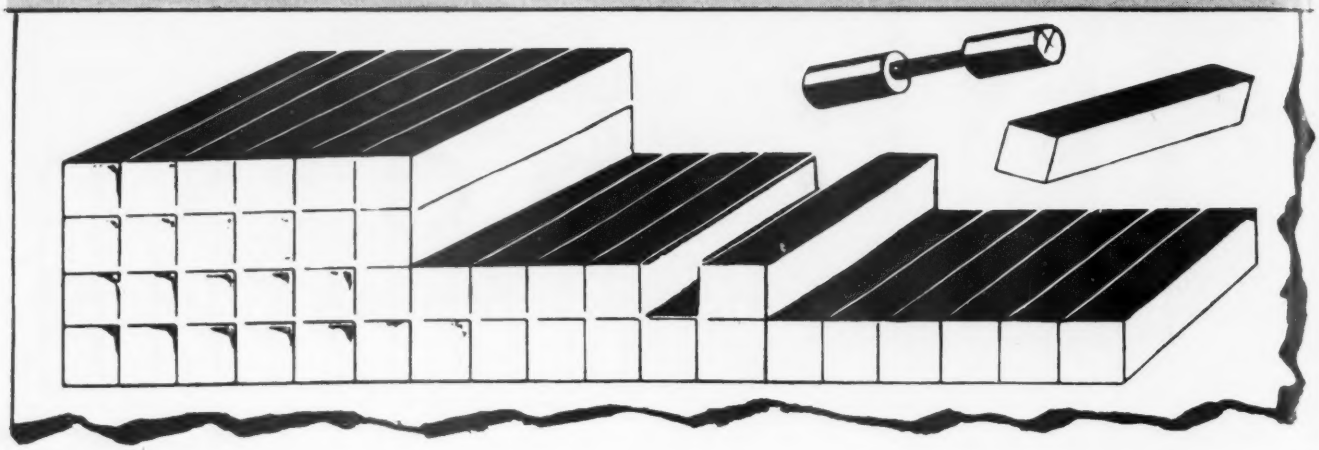
If You Want the Physical Properties of the TEST BAR in Your Castings— *Use* FRONTIER 40-E ALUMINUM ALLOY!



ORDINARILY the physical properties of an aluminum-alloy casting are less than those of a separately-cast test bar. But because of the special qualities of FRONTIER 40-E — the *non-heat-treated* aluminum alloy — you can be sure that *the same high qualities which show up in the test bar will appear uniformly throughout a large casting.* The following tables tell the story:

40-E Step Block Casting Cut Into 42 Test Bars—Physical Properties of each Shown in Squares.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Y.S.	22.5	20.0	21.2	20.6	20.5	22.0	20.8	21.0	21.8	22.5	23.0	23.4	23.0	25.0	23.8	22.5	23.5	24.6
T.S.	38.3	33.0	33.1	32.7	33.8	36.0	33.8	32.5	33.5	34.5	34.0	37.2	37.8	39.0	36.8	36.5	36.7	40.0
El.	12.5	10.0	6.0	4.0	7.5	7.5	8.0	7.0	7.0	7.5	7.0	8.0	8.5	8.5	7.5	8.0	7.5	10.0

	30	29	28	27	26	25	24	23	22	21	20	19
Y.S.	22.0	23.0	22.5	21.5	22.5	23.5	22.5	23.5	23.5	23.8	22.8	23.8
T.S.	36.3	35.3	35.3	35.0	35.0	37.3	34.5	32.0	32.5	32.5	35.0	38.3
El.	10.0	6.0	9.0	7.5	7.5	6.0	5.0	5.0	5.0	5.0	7.5	7.5

	31	32	33	34	35	36
Y.S.	23.0	22.8	22.5	24.0	23.5	23.0
T.S.	36.3	33.3	32.5	32.5	36.3	39.0
El.	8.0	5.0	5.0	5.0	7.0	8.5

	42	41	40	39	38	37
Y.S.	23.3	23.7	23.0	23.2	23.0	22.5
T.S.	33.2	37.1	36.4	37.3	38.0	40.8
El.	3.0	8.0	6.5	6.5	11.0	11.0

SEPARATELY-CAST TEST BAR PROPERTIES		
Nat. Aged 21 days	Y.S.	23500
	T.S.	36600
	El.	7.5

Properties of Casting (based on tensile strength readings)

	Maximum	Minimum	Average
Y.S.	25,000	22,500	22,700
T.S.	**40,800**	**32,500**	**35,500**
El.	11.0	5.0	7.5

Write TODAY for full details about Frontier 40-E Aluminum Alloy, including FREE DATA BOOK.

40-E Meets These Government Specifications:

U. S. Army-Navy Air Corps	AN-A-17
U. S. Navy, Bureau of Aeronautics	AN-A-17
U. S. Navy, Bureau of Ships	46A1F Class 1 (Int)
A. S. T. M.	B-26-46T-ZG41
S. A. E.	310
U. S. Army Ordnance	AXX-1348

FRONTIER BRONZE CORPORATION

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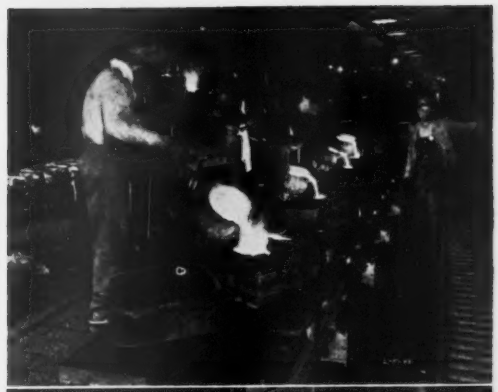
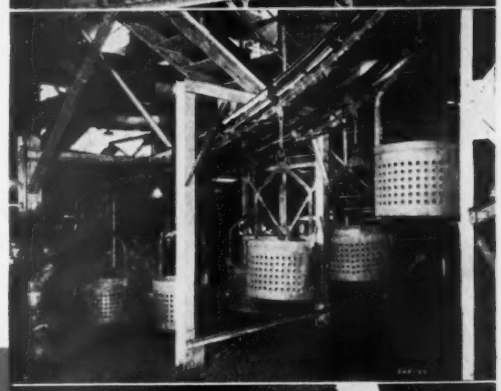
He's a Specialist





Yes, Jeffrey Foundry Engineers know their business . . . they have designed and equipped some of the largest foundries in this country. At the same time, they do not lose sight of the fact that small foundries need mechanized equipment to do a better job economically. They serve both—constructively.

You can put your modernization program squarely up to Jeffrey Foundry Sales Engineers. They will be glad to submit recommendations . . . to help you mechanize for profit. Photos shown here depict just a few of the large jobs engineered and erected by Jeffrey. Names upon request. Let us hear from you—if you want the right answers.

- Aerators
- Flask Fillers
- Mold Conveyors
- Feeders
- Screens
- Transmission Machinery
- Bucket Elevators
- Crushers
- Sand Preparation Equipment
- Sanditioners
- Apron & Belt Conveyors

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The Kilbourne & Jacobs Mfg. Co., Columbus, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

JM

A COMPLETE LINE OF *Scientifically* DELTA FOR *Faster Production* OF FINER-FINISH CASTINGS

DELTA products for the foundry are PRODUCTS OF RESEARCH. For nearly twenty years many important scientific developments . . . valuable contributions to the advancement of foundry practices . . . have originated in DELTA'S laboratories where the most modern scientific facilities are employed in a continuing program of product research, development and standardization.

Every DELTA Foundry Product is first tested by laboratory methods then submitted for use and final approval in ACTUAL FOUNDRY PRACTICE before it is identified with the name "DELTA".

There is no "just as good" substitute for ANY Delta Foundry Product just as there is no substitute for DELTA'S scientific controls which safeguard the quality and uniformity of all DELTA Foundry Products.

Among the many "FIRSTS" introduced by DELTA laboratories are Plastic-type Core and Mold Washes and, more recently, a Sand Release Agent (96-B) embodying unique and distinctive characteristics.

DELTA CONTINUES TO LEAD IN THE DEVELOPMENT OF NEW PRODUCTS FOR IMPROVED FOUNDRY PRACTICE.

EVELOPED FOUNDRY PRODUCTS

CORE AND MOLD WASHES:

FOR STEEL:

Delta Special Core & Mold Wash Base — Used by more steel foundries than all other types of washes combined.

Delta SteelKoat — a finished high fusion waterproof wash.

FOR ALL TYPES OF SAND CAST METALS:

Delta ThermoKoat — It's plasti-lastic, non-heat shocking, highest fusion and hot strength.

Delta Z-Koat — a zirconium wash with unusual properties in contact with molten metal.

FOR GRAY IRON, MALLEABLE, BRONZE AND BRASS:

Delta GraKoat — no reaction with molten metal.

Delta BlacKoat — a black wash, free from carbon, no gas in contact with molten metal.

FOR GRAY IRON:

Delta BlacKoat S-5 — a new and different wash. Produces results, on gray iron castings, unequalled by any other wash.

FOR NON-FERROUS AND LIGHT METALS:

Delta NonferrusKoat — produces unusually smooth surface castings.

VISIT US AT OUR SUITE
at the
SHERATON HOTEL, BUFFALO, N. Y.
during the
55th
ANNUAL A.F.S. CONVENTION

PARTING COMPOUNDS:

Delta Partex — (Nutshell partings) has lycopodium properties, non-injurious and non-hazardous to use.

Delta Liquid Parting — Low-cost, highly effective and lasting.

MUDDING & PATCHING COMPOUNDS:

Delta Sliktite — a light colored mud for all types of metal castings.

Delta Ebony — a black mud for gray iron, malleable and nonferrous work. All mudding compounds seal core joints and hold joints together at high temperatures.

NO-VEIN COMPOUND:

A special compound, not iron oxide. A high hot strength and sand plasticizing material. Stops veins and penetration.

MOLD SURFACE BINDERS—LIQUID:

Delta Spray Binders — Produce dry sand mold results by surface spraying of green sand molds.

DRI-BOND:

A new type of Dry Binder which provides new economies. Fast-baking, reduces veining and penetration. Can be used with old sand equally as well as with new sand.

PERMI-BOND:

Eliminates Sea Coal Nuisance: The new modern scientific sea coal replacement.

BONDITE:

Produces a reducing mold atmosphere:

For Steel and Gray Iron — Use Delta Bondite, a dry binder which becomes waterproof on drying and produces mold atmosphere which is high in reducing gas.

96-B SAND RELEASE AGENT:

Another Foundry *"First"* by Delta. By adding 8 oz. or less per ton to your core or molding sand mixes, your sands will flow freely. 96-B is completely volatile at elevated temperatures and does not contaminate the sand.

CORE ROD DIP OIL NO. 224X:

Ties core rods and wires into the cores:

Rods and wires coated with Delta Core Rod Dip Oil adhere to the sand. Eliminates need for 50% of the rods and wires and reduces core breakage.

DELTA SAND CONDITIONING OIL:

Sticking core sand mixes work freely in core boxes when sand conditioning oil is added to core sand mixes.

CORE OILS:

High tensile, low gas, faster baking, exceptionally economical to use.

Get the Facts . . .

Working samples and complete literature on Delta Foundry Products will be sent to you on request for test purposes in your own foundry.

DELTA
OIL PRODUCTS CO.
Manufacturers of Scientifically Controlled Foundry Products
MILWAUKEE 9, WISCONSIN

Castings ground smooth in single-step operation

Aluminum canopy beams for Lockheed fighters finished 100% faster with new 3M Backstand Method of grinding

Linmold Company, Compton, California, reports the 3M Backstand Method has eliminated one entire grinding operation. Flash and gates on aluminum castings are now cut close with a metal saw—then ground smooth in a single step. Snagging wheels and set-up wheels are no longer needed. Grinding time is cut in half!

The 3M Backstand Method and 3M Abrasive Belts can cut finishing costs in your plant, too. And standard grinding and polishing equipment is easily and quickly converted to the new system.

Write Dept. FO-451 for your copy of "Step Up Production" book explaining this cost-cutting method. Use coupon below.

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Please send me copy of "Step Up Production" booklet.

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City.....State.....

Made in U.S.A. by MINNESOTA MINING & MFG. CO., St. Paul 6, Minn., also makers of "Scotch" Brand Pressure-sensitive Tapes, "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-Slip Surfacing, "3M" Adhesives. General Export: Durex Abrasives Corp., New Rochelle, N. Y. In Canada: Canadian Durex Abrasives Ltd., Brantford, Ontario.

Readers' COMMENT

How To Melt the Big Ones

TO THE EDITORS:

Recently a young foundryman asked me what was the limiting size of a piece of scrap that might be melted in a cupola. I told him I did not have a direct answer, but he might be interested in an early experience I had while in charge of a shop where the iron was melted in a cupola lined to 28 in. For years several large pieces of scrap carefully had been ignored because apparently they could not be broken to acceptable cupola size. These included disks about 24 in. diam, 6 in. thick, estimated weight 700 lb, and other pieces cylindrical in cross section, 12 in. diam, 4 ft long and weighing about 1400 lb.

Up to that time I never had seen a big solid iron lump melted in a cupola. When I proposed to melt these pieces, I was told it could not be done. It was claimed that the heavy lump of iron simply would crush its way down through the coke bed until it came to rest on the bottom doors. The furnace would freeze up and I would be lucky if I did not have to cut away the shell to remove the mess.

I hated to think of those excellent pieces of iron going to waste. Also I reasoned that if a cupola could melt 1000-lb charges of iron made up of small pieces, it should be able to melt the same amount, even if it was all in one piece. Through a well developed bump of curiosity in those days I wanted to determine definitely whether it was necessary to waste time and money breaking pig iron and scrap into small pieces.

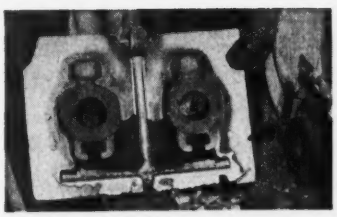
We rigged a block and tackle and lifted one of the long pieces up to the charging floor. It was the largest one of the lot. I was satisfied that if we could melt it, we would have no trouble with the others. The usual coke bed was placed in the cupola, followed by one charge of iron and the usual coke split. We shifted the block and tackle to a beam directly over the charging door.

(*Continued on page* 96)

Resin bonded shell mold showing back (left) and face (right).

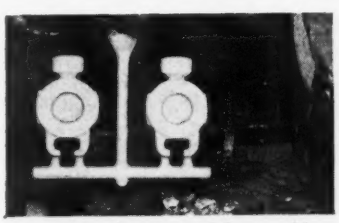
How to boost your production:

Use Monsanto Resinox resins with new shell molding process



Removal of casting from mold.

Not only does the Shell Molding ("C") Process help you speed up production, but it enables you to get castings with a superior finish . . . and castings with dimensional accuracy comparable to that achieved by precision casting techniques. And there are other advantages you will want to look into:



Casting after removal from mold.

1. Better metal yields (more castings per pound of metal poured)
2. Castings requiring little or no cleanup
3. Less sand handling
4. Excellent castings of intricate shapes and thin sections

Monsanto manufactures a wide range of Resinox phenolic resins research-built for the Shell Molding Process, and others already used by many foundries to improve cores, and reduce baking cycles up to 50%. *For more information about the new Shell Mold Process, and for data on Resinox for molds and core binding, please send the coupon below.* Resinox: Reg. U. S. Pat. Off

MONSANTO
CHEMICALS AND PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

MONSANTO CHEMICAL COMPANY, Plastics Division,
Room 5701, Springfield 2, Mass.

☐ Please send me your booklet, "The 'C' Process for Making Molds and Cores for Foundry Use."

☐ Please send me information on Resinox for _____

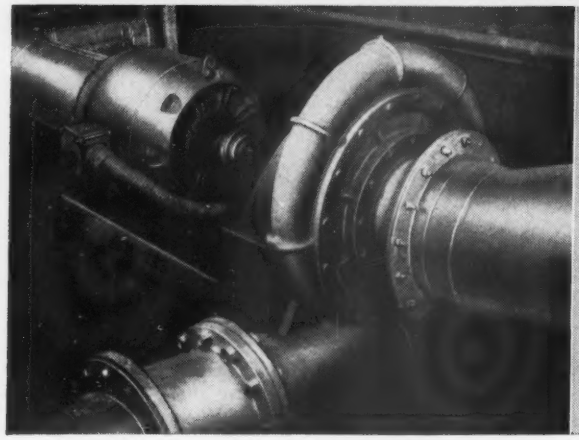
Name & Title _____

Company _____

Address _____

City, Zone, State _____

Keep your eye on V-P-1 WHEN SELECTING BLOWERS



CENTRIFUGAL

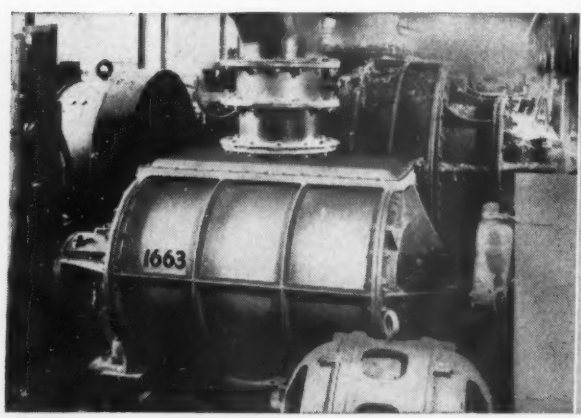
Type OIB Centrifugal Blower for cupola service in western foundry. Capacity 6,000 cfm.

You can't afford to risk cupola shutdowns today because of unsatisfactory or inadequate equipment performance. To keep production moving at the required fast pace, calls for blowers that continuously deliver positive Volume at required Pressure —and at Low power costs to reduce operating expense.

You get these 3 essentials from R-C Blowers. Whether your needs call for Centrifugal or Rotary Positive units, we can match them from our exclusive *dual-ability line*. With capacities from 5 cfm to 100,000 cfm, you can usually find R-C units that closely fit your demands, with resultant savings in time, cost, space, weight and power.

From an experience of almost a century of blower building, our engineers will gladly make suggestions of the right R-C equipment to keep cupolas going at top capacity to meet today's urgent demands.

ROOTS-CONNERSVILLE BLOWER CORPORATION
510 Madison Avenue, Connersville, Indiana



ROTARY

RCS Rotary Positive Blower with capacity of 4,500 cfm, used to supply cupola air in locomotive plant. Other R-C Blowers are shown in background.

ROOTS-CONNERSVILLE

BLOWER BUILDERS R-C SINCE 1854

ONE OF THE DRESSER INDUSTRIES

(*Continued from page* 94)

After considerable grunting and maneuvering we lowered the long piece of scrap into the cupola. It was adjusted upright in the center and held there until about 200 lb of miscellaneous scrap was packed around the lower end. This was followed by the usual amount of coke for the second charge. Three charges of scrap and coke brought the last charge flush with the top of the long piece and also flush with the sill of the charging door.

The blower was started and as the column of iron and coke settled, the remainder of the material for the daily heat was charged in the usual manner. The iron melted as calmly and quietly as if no liberties had been taken with the charging method. The furnace was perfectly clean when the bottom dropped. We handled the remainder of the pieces one each day, in like manner. The disks were set up on edge and surrounded with scrap and coke. They slipped through as readily as the long pieces. I don't mind admitting my heart was in my mouth for the first half hour of the initial trial. It was needless worry.

OLD TIMER

* * *

Dry Binder Available

TO THE EDITORS:

In the January issue of your publication's Questions and Answers, somebody inquired for a dry core binder to be used for a bronze bearing. It so happens that we produce a dry core compound that I am sure will do this job and is being used now in nonferrous shops for this purpose.

J. W. COPPS
Vice President

Metro-Nite Co.
Milwaukee, Wis.

* * *

Finds Booklets Useful

TO THE EDITORS:

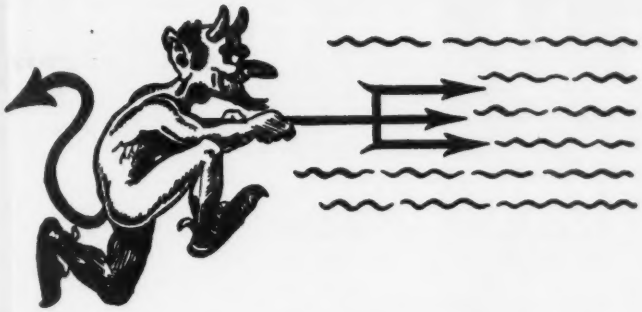
Thanks for your fine co-operation in sending us the "Foundry Industry Data Book, 1949-50," and "Foundry Market Atlas." Information contained in these two publications will help us in our work in offering assistance to foundries regarding the training of their manpower.

Everyone is aware of the vital part foundries and their skilled personnel play in the war effort and the Department of Labor hopes to contact and assist as many of the foundries as possible with their training problems.

Having served my apprenticeship in the foundry and spent a total of 11 years in the trade, you can see I have

(*Concluded on page* 98)

New Head Compound Saves Metal!



Soffel's New

Thermotomic "HOTOP" Carbon Free Liquidizer

SOFFEL'S THERMOTOMIC "HoTop" AN EXOTHERMIC CARBON FREE LIQUIDIZER FOR IRON AND STEEL — SAVES METAL

SOFFEL'S THERMOTOMIC HoTop CARBON FREE LIQUIDIZER is an entirely new head compound, developed for use to reduce the height of feeding risers to one-third or one-half of their diameters. For an example, 6" x 6" feeding risers can be reduced 2" to 3" in height.

SOFFEL'S THERMOTOMIC HoTop CARBON FREE LIQUIDIZER is different from other head compounds in that SOFFEL'S THERMOTOMIC HoTop does *NOT* contain any powdered *metal*, is *NOT* a thermit type riser compound. It is a patented exothermic compound entirely free of metal, carbon, sulfur and phosphorous and can be used without danger of contamination on any ferrous metal or alloy.

SOFFEL'S THERMOTOMIC HoTop will permit reduction of feeding riser heights 60 to 70%. THERMOTOMIC HoTop LIQUIDIZER will produce temperatures well above 4000° F. This high heat increases the temperature of the feeding metal well above that of the metal in the main body of the casting, thus ensuring that the feeding metal will be the last to freeze. Shrink cavities under the feeding heads and porosity in the castings caused by premature freezing of the feeding metal are entirely eliminated.

Many advantages are to be gained by the use of SOFFEL'S THERMOTOMIC HoTop; chills in molds to induce directional solidification can in great measure be eliminated. A large amount of pouring metal is saved because of the smaller amount of metal required for feeding risers. Many more castings can be poured from a standard heat. The great reduction in heights of heads also saves metal, cost of remelting, also molding time. SOFFEL'S THERMOTOMIC HoTop will more than pay for its cost of use in savings of metal.

One major user, producing large castings has been able to reduce the pouring weight on one casing from 96,000 pounds to 76,000 pounds. This same user has poured twenty or more of these castings without any piping or shrinkage from the feeding heads into the casting since using SOFFEL'S THERMOTOMIC HoTop LIQUIDIZER. This not only represents a great savings in money and metal but permits an additional 20,000 pounds of metal that was saved from each casting, to be poured into other castings. SOFFEL'S THERMOTOMIC HoTop LIQUIDIZER produces equal savings on smaller castings also.

OTHER USES FOR IRON AND STEEL

SOFFEL'S THERMOTOMIC HoTop CARBON FREE LIQUIDIZER can be used in the ladle to increase the temperature of cold heats. It is also used to prevent or eliminate skulls in ladles. The great amount of heat and fluidity which it develops makes it ideal for the above applications.

SOFFEL'S THERMOTOMIC HoTop CARBON FREE LIQUIDIZER is also being used with a great deal of success as a hot topping in ingot production. Its great heat generating and insulating value combined with the fact that it contains no powdered metals which could contaminate the metal, makes it particularly suitable for eliminating hot tops in the production of ingot steel.

Complete Instructions for reducing various heights of risers, are furnished with SOFFEL'S THERMOTOMIC HoTop LIQUIDIZER. See your supplier or write us for trial sample.

Beware of Imitations: **We are the originators of Exothermic Carbon Free Liquidizer**

PITTSBURGH METALS PURIFYING COMPANY

Manufacturers of Fluxes and Purifiers for All Metals and Alloys

1352 MARVISTA ST., N. S. PITTSBURGH 12, PA.

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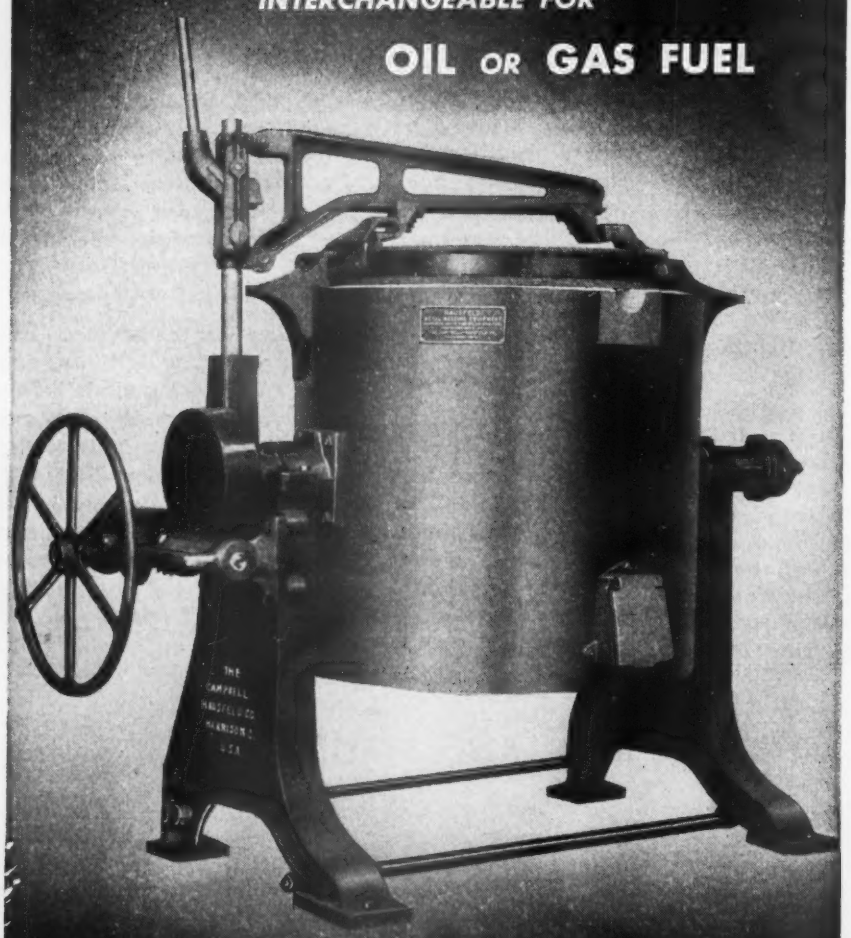
A FURNACE FOR EVERY NON-FERROUS MELTING REQUIREMENT

INTERCHANGEABLE FOR

OIL OR GAS FUEL



Built for Service

The Campbell-Hausfeld Co.

300-320 MOORE ST. HARRISON, OHIO

(*Continued from page* 96)

a personal interest as well as a job to do in behalf of the United States Department of Labor in helping the foundry industry whenever possible.

WILLIAM C. WEBB
Area Supervisor

U. S. Department of Labor
418 *Federal Building*
Columbus 15, *O.*

* * *

Editorially Speaking

TO THE EDITORS:

The last several months I have been wanting to write you regarding the editorials which appear in FOUNDRY.

I think these editorials are very timely, to the point, and that they are definitely helpful in letting the administration in Washington know what foundrymen think of the present chaotic conditions in most of the defense departments. I am glad that you keep emphasizing these conditions, because it is only through repetition that government representatives will understand our problems.

WALTER L. SEELBACH
President

Superior Foundry Inc.
Cleveland

●

TO THE EDITORS:

The editorial in the March FOUNDRY hits the nail right on the head, and I hope your personal record for calling the shots will come through in the matter covered in this editorial.

D. H. WORKMAN
Executive Vice President

Gray Iron Founders' Society
Cleveland 14

* * *

Index for 1950 Available

TO THE EDITORS:

Would appreciate copy of index to FOUNDRY, Vol. 78 for which kindly accept my thanks in advance.

At this time allow me to congratulate you on the new appearance of FOUNDRY; it really is keeping up with foundry progress in general. Every reader should be proud of this newer, modern up-to-date magazine.

BEN J. REJONA

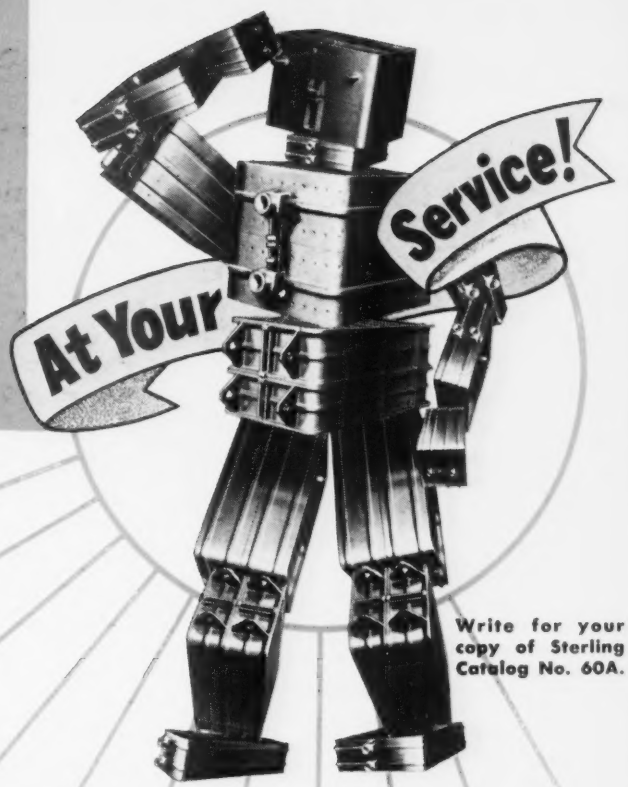
354 *Kendalia*
San Antonio 4, *Tex.*

Worthington Pump & Machinery Corp., Harrison, N. J., has appointed Hutchinson Foundry & Steel Co., "D" & Washington Sts., Hutchinson, Kans., distributor of its line of construction equipment. Carl R. Klaver is industrial sales manager for the Hutchinson foundry.

Sterling

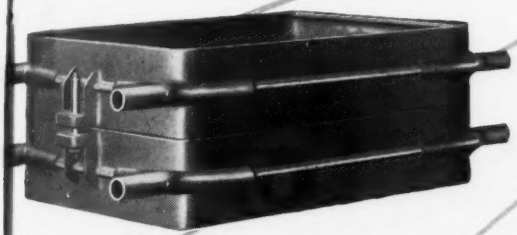
ROLLED STEEL CHANNEL FOUNDRY FLASKS

Produce Better Castings!

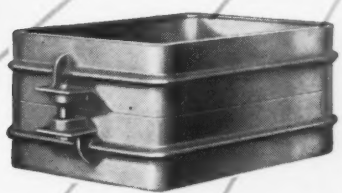


North American foundries . . . more than 4,500 of them . . . have adopted Sterling Steel Flasks for greater efficiency, longer life and more profitable foundry operation. These same foundries continue to specify Sterlings whenever more flasks are needed. That's because Sterlings have the strength and rigidity to resist distortion and to take hard, everyday punishment. Fabricated from special rolled steel channel into one solid, rigid piece, Sterling Flasks are capable of withstanding tremendous pressures. They retain their rigidity and accuracy over a long period of years. Available in a variety of styles and shapes.

Write for your copy of Sterling Catalog No. 60A.



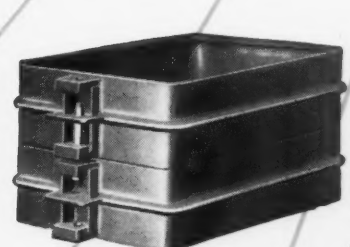
Style "GSX"
with Single Pin Lugs and Two-Man Lift Handles



Style "E"
with Pin Lugs and Handles Combined

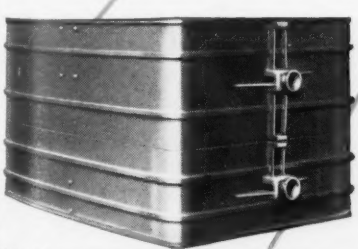
Style "⅜ND-RTX Cope" — Style "⅜NS-RT Drag"
with Heavy Duty Clamps (Patent No. 1974292)

Style "AD"
Flask Sections Stacked One Above Another
for Multiple Molding

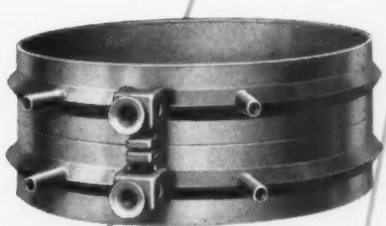


Style "AD"
with Double Pin Lugs

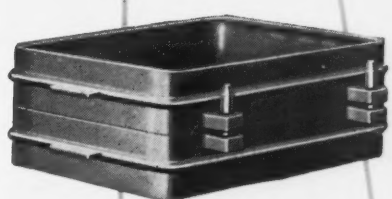
Style "LS"
with Angle Reinforcement
and Two-Man Lift Handles



Style "⅜ND-RT Cope" — Style "⅜NS-RT Drag"
Heavy Duty Flask (Patent No. 1974292)



Style "BLST"
with Trunnions and Two-Man Lift Handles



Style "H"
with Pin Lugs Welded on Sides

STERLING WHEELBARROW CO., Milwaukee 14, Wis., U. S. A.

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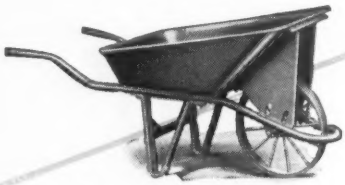
Sterling

FOUNDRY EQUIPMENT

for Heavy-Duty Foundry Work

In addition to Steel Flasks, Sterling offers a complete line of Flask accessories and a variety of foundry equipment. Custom-built for heavy duty foundry service and high-speed production schedules, every piece of equipment is backed by the well-known Sterling reputation for correct design and excellent workmanship. The Company has always maintained a policy of fabricating to high quality standards. Consult Sterling the next time you require foundry equipment. The Sterling branch office near you will gladly give you information and estimates — or write to factory.

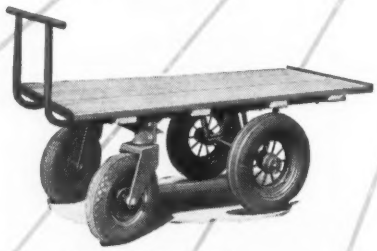
Write for you copy of Sterlin Catalog No. 60



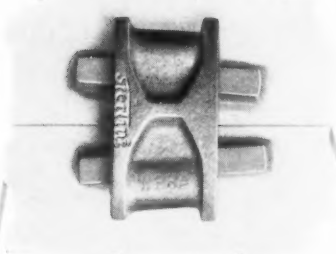
No. 116-A Heavy Duty Wheelbarrow

No. 47 Casting Cart

No. 50 Slag Buggy

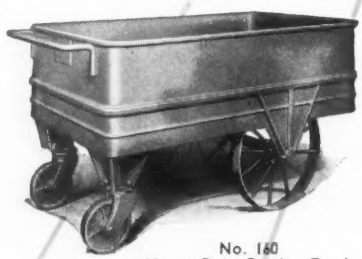


No. 110-A Core Truck

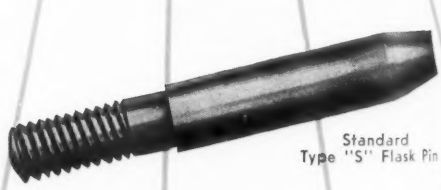


Sterling Flask Clamp

No. S-5W Wheelbarrow for sand and other dry materials

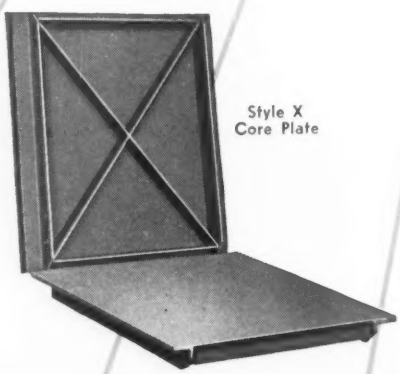


No. 160
Heavy Duty Casting Truck

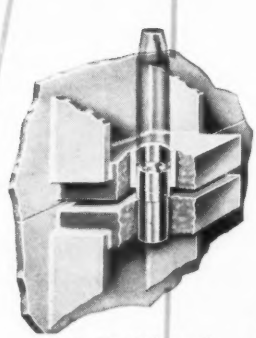


Standard
Type "S" Flask Pin

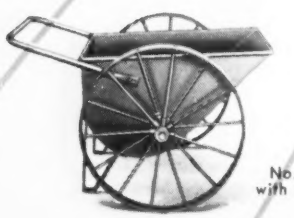
Heavy Duty Cart with "3-Point Landing"



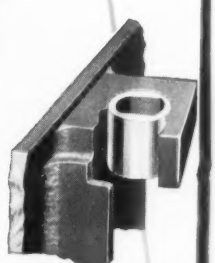
Style X
Core Plate



Stub Pin Shift-proof



No. 630-S Cart with Steel Wheels



Standard Hardened Stee Bushing

STERLING WHEELBARROW CO., Milwaukee 14, Wis., U. S. A.

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Why Spend Only Peanuts?

DURING the last few years two developments of the foundry industry resulted in tremendous interest among both producers and consumers of castings. These were the production of nodular iron and the introduction of the shell molding process. Foundrymen saw in nodular iron and in the shell molding process the possibility of new production methods which would enlarge their market. Customers felt that the properties of nodular iron might offer a solution to certain component problems and that the shell process provided a method of casting to close tolerance. Reception which greeted the announcement of both processes provides an indication of the interest which awaits the unusual in the field of castings.

Continuing progress in foundry methods and products is most important in meeting the emergency demands that lie immediately ahead. At the same time the foundry industry should be looking forward to the day when the emergency is over and the problem of selling castings against competition again arises. To meet the challenge for the immediate future and for the long-range pull, the foundry industry needs to embrace the field of co-operative research to a degree that will produce substantial results.

The foundry industry today is conducting a certain amount of basic co-operative research through some of its technical and trade societies. While complete data on the amount of money being spent for such research are not available, a generous estimate of the total would seem to indicate an expenditure not to exceed $200,000 annually. Comparing this with the record recent yearly production of 16,500,000 tons of castings, it will be seen that the industry is spending for co-operative research only about 1.2 cents per ton of castings produced. Surely this is far short of the amount that should be devoted to that kind of research if the foundry industry is to keep pace with competitive forms of fabrication.

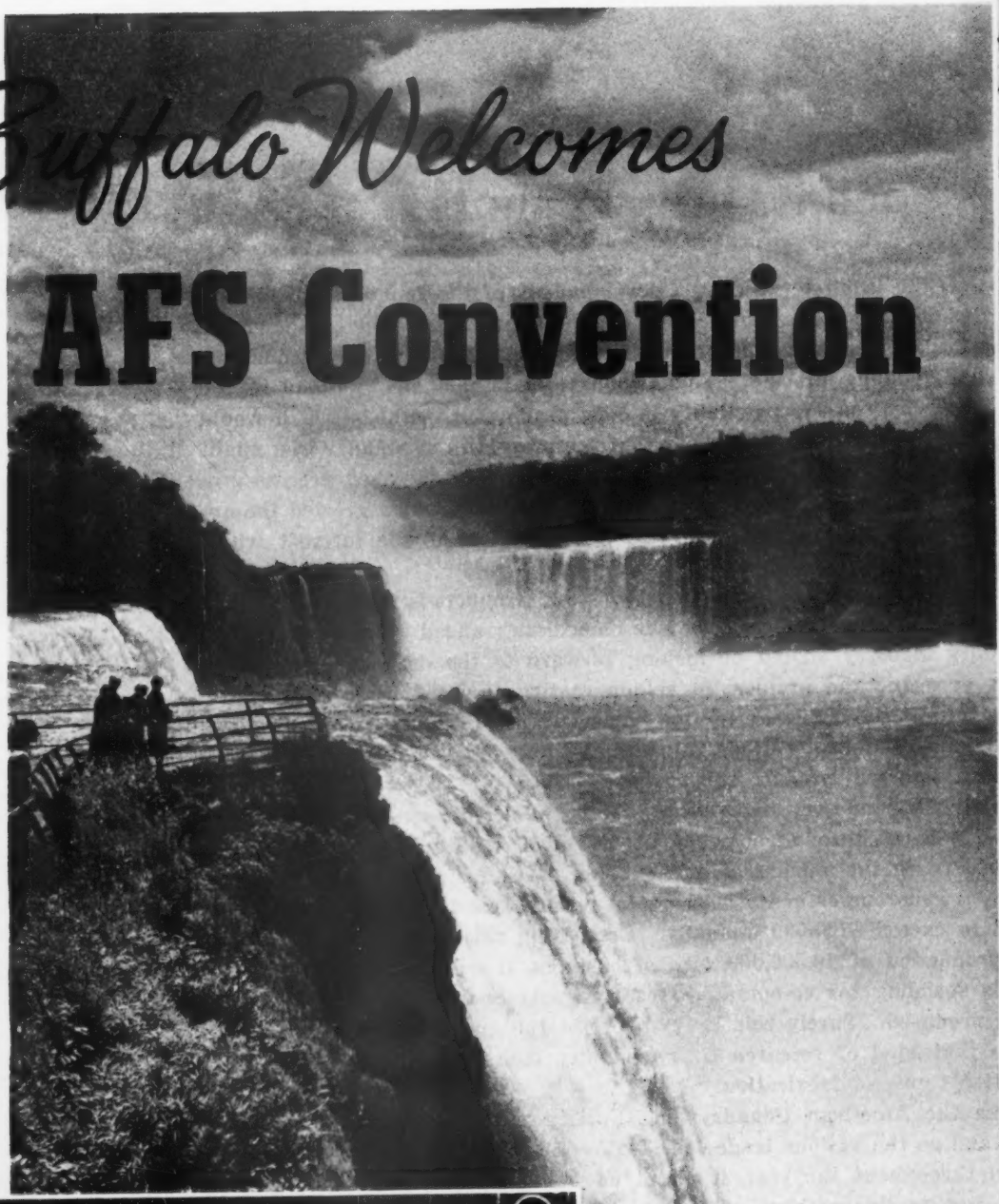
When the American Foundrymen's Society meets later in the month in Buffalo, and as the various trade societies of the foundry industry hold annual meetings throughout the year, it might be well for members to give greater consideration to this problem of co-operative research. If an adequate job is not being done, steps should be taken to get research programs under way or to enlarge the scope of those now in progress.

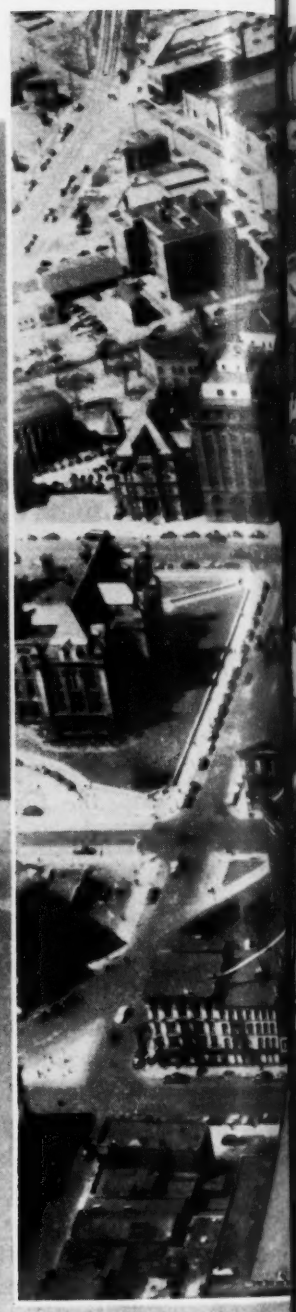
New market possibilities beckon.

Frank G. Steinebach
Editor

Buffalo Welcomes

AFS Convention





FOR the fourth time in history Buffalo will be host to the foundry industry when the American Foundrymen's Society holds its 55th annual convention there, Monday through Thursday, Apr. 23-26.

A full program of technical sessions is scheduled by each of the society's various divisions. Annual business meeting of AFS will be held Wednesday afternoon, and the annual banquet will conclude the convention Thursday evening. Other featured events will include the Charles Edgar Hoyt Annual Lecture, visits to Buffalo district plants, group roundtable luncheons and dinners, and an entertainment program for visiting ladies. Details of the week's program are presented on the next four pages, and members of committees appointed by the host Western New York Chapter to handle various convention arrangements are listed on pages 110-113.

Registration headquarters for the convention will be at Hotel Statler. The official badge will be required for admission to all technical sessions except the evening shop courses. Registration fee will be $2 for AFS members and $5 for nonmembers.

Technical Program—Interest at this year's meeting will center on the technical program, since the biennial exhibit of foundry equipment and supplies is not scheduled until 1952. A high light of the program is expected to be a symposium on gating and risering sponsored jointly by the four metals divisions. This will be held in morning and afternoon sessions on Tuesday and will cover not only general considerations relating to gating and risering practice, but also specific factors applying to individual metals. Research developments on the subject will be discussed by representatives of the Naval Research Laboratory and Battelle Memorial Institute. Among other speakers will be: A. K. Hig- (*Please turn to page* 159)

CONVENTION *Program*

● Monday, April 23

8:30 a.m.—Registration begins

10 a.m. (A)—Aluminum and Magnesium Session
Presiding—J. J. Warga, Piasecki Helicopter Corp., Morton, Pa. Co-chairman—P. J. Scherbner, Sperry Gyroscope Corp., Great Neck, Long Island, N. Y.
Melting Aluminum and Magnesium Base Alloys—L. W. Eastwood, Battelle Memorial Institute, Columbus, O.
Fluid Mechanics Applied to Founding—W. O. Wetmore and D. S. Richins, U. S. Naval Ordnance Test Station, Pasadena, Calif.

10 a.m. (B)—Brass and Bronze Session
Presiding—W. B. Scott, National Bearing Division, American Brake Shoe Co., Meadville, Pa. Co-chairman—H. G. Schwab, Bunting Brass & Bronze Co., Toledo.
Refining Secondary Copper Alloys—Marvin Glassenberg and L. F. Mondolfo, Illinois Institute of Technology, Chicago, and A. H. Hesse, R. Lavin & Sons Inc., Chicago.
Radiography as an Assistant to Foundry Practice—S. A. Brosky, Pittsburgh Testing Laboratory, and C. B. Johnson, Rockwell Mfg. Co., Pittsburgh.
Riser Efficiency Increased by Insulation—James O'Keeffe Jr., Exomet Inc., Conneaut, O.

10 a.m.—Heat Transfer Session
Presiding—H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland. Co-chairman—E. C. Troy, foundry engineer, Palmyra, N. J.
Freezing of White Cast Iron in Green Sand Molds—H. A. Schwartz and W. K. Bock, National Malleable & Steel Castings Co., Cleveland.
Heat Flow in Moist Sands—Progress Report, Heat Transfer Research—V. Paschkis, Columbia University, New York.

10 a.m.—Malleable Session
Presiding—E. C. Zirzow, Deere & Co., Moline, Ill. Co-chairman—F. J. Pfarr, Lake City Malleable Co., Cleveland
Malleable Core Practice as Related to Foundry Losses—E. J. Jory, National Malleable & Steel Castings Co., Cicero, Ill.
Modern Core Sand Practice—R. H. Greenlee, Auto Specialties Mfg. Co., St. Joseph, Mich.

12 Noon (A)—Aluminum and Magnesium Roundtable Luncheon
Presiding—R. F. Cramer, General Electric Co., Schenectady, N. Y. Co-chairman—J. W. Meier, Department of Mines and Technical Surveys, Ottawa, Canada.
Subject: *Centrifugal Casting*

12 Noon (B)—Brass and Bronze Round Table Luncheon
Presiding—B. A. Miller, Baldwin-Lima-Hamilton Corp., Eddystone Division, Philadelphia. Co-chairman—H. L. Smith, Federated Metals Division, American Smelting & Refining Co., Pittsburgh.
Subject: *Problems in Brass and Bronze Foundries.*

2 p.m. (A)—Educational Session
Presiding—W. H. Ruten, Polytechnic Institute of Brooklyn, N. Y. Co-chairman—B. D. Claffey, Acme Aluminum Alloys Inc., Dayton, O.
Development of Foundry Courses in High and Trade Schools—R. W. Schroeder, University of Illinois, Chicago.
Industry Participation in Secondary School Training Programs for the Foundry—T. W. Russell Jr., American Brake Shoe Co., New York.

2 p.m. (B)—Heat Transfer Session
Presiding—Dr. H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland. Co-chairman—E. C. Troy, foundry engineer, Palmyra, N. J.
Solidification of Steel Against Sand and Chill Walls—H. F. Bishop, F. A. Brandt and W. S. Pellini, Naval Research Laboratory, Washington.
Solidification of Gray Iron in Sand Molds—R. P. Dunphy and W. S. Pellini, Naval Research Laboratory, Washington.

2 p.m. (C)—Malleable Session
Presiding—C. F. Lauenstein, Link-Belt Co., Indianapolis. Co-chairman—F. Coughlin Jr., Albion Malleable Iron Co., Albion, Mich.
Relative Effects of Chromium and Silicon Contents on Rate of Anneal of Black-Heart Malleable Iron—J. E. Rehder, Department of Mines and Technical Surveys, Ottawa, Canada.
Part I—Oxidation-Reduction Principles Controlling the Composition of Molten Cast Irons—R. W. Heine, University of Wisconsin, Madison, Wis.

4 p.m. (A)—Aluminum and Magnesium Session
Presiding—M. E. Brooks, Dow Chemical Co., Bay City, Mich. Co-chairman—W. D. Danks, Howard Foundry Co., Chicago.
Magnesium As a Die Casting Material—R. C. Cornell, Litemetal Diecast Inc., Jackson, Mich.
Castability and Property Comparison of Several Magnesium-Rare Earth Sand Casting Alloys—K. E. Nelson and F. P. Strieter, Dow Chemical Co., Midland, Mich.
The Modification Technique of Aluminum-Silicon Alloys—Official Exchange Paper from the Institute of Australian Foundrymen—R. Dyke, Defense Research Laboratories, Marybirnong, Victoria.

4 p.m. (B)—Brass and Bronze Session
Presiding—B. N. Ames, New York Naval Shipyard, Brooklyn, N. Y. Co-chairman—M. G. Dietl, Crane Co., Chicago.
U. S. Navy Nonferrous Development Program—Clyde L. Frear, Bureau of Ships, Department of Navy, Washington.
Melt Quality and Fracture Characteristics of 85-5-5-5 *Red Brass and* 88-8-4 *Bronze*—AFS Research Report—R. D. Shelleng, C. Upthegrove and F. B. Rote, University of Michigan, Ann Arbor, Mich.

4 p.m. (C)—Malleable Session
Presiding—W. D. McMillan, International Harvester Co., Chicago. Co-chairman—William Zeunik, National Malleable & Steel Castings Co., Indianapolis.
Part II—Oxidation-Reduction Principles Controlling the Composition of Molten Cast Irons—R. W. Heine, University of Wisconsin, Madison, Wis.
Malleable Cast Iron Annealing Furnaces and Atmospheres—O. E. Cullen and R. J. Light, Surface Combustion Corp., Toledo.

5:30 p.m.—Registration closes

7 p.m.—Educational Dinner
Presiding—G. J. Barker, University of Wisconsin, Madison, Wis. Co-chairman—G. K. Dreher, Foundry Educational Foundation, Cleveland.
What the College Graduate Can Do for the American Foundryman—C. J. Freund, University of Detroit, Detroit.
Absorbing the Technical Trainee in Industry—C. L. Carter, Albion Malleable Iron Co., Albion, Mich.

8 p.m. (A)—Brass and Bronze Sand Course
Presiding—W. W. Edens, Badger Brass & Aluminum Foundry Co., Milwaukee. Co-chairman—G. P. Halliwell, H. Kramer & Co., Chicago.
Basic Approach to Sand Control for Copper Base Alloy. Part I—Structural, Green, Air Set and Dry Properties. Discussion leader: H. W. Dietert, Harry W. Dietert Co., Detroit.

8 p.m. (B)—Gray Iron Shop Course
Presiding—W. W. Levi, Lynchburg Foundry Co., Radford, Va. Co-chairman—E. J. Burke, Hanna Furnace Co., Buffalo.
Air in the Cupola. Discussion leader: D. E. Krause, Gray Iron Research Institute Inc., Columbus, O.

8 p.m. (C)—Sand Shop Course
Presiding—F. S. Brewster, Harry W. Dietert Co., Detroit. Co-chairman—E. L. Thomas, Cadillac Motor Car Co., Detroit.
Malleable Foundry Sand Control. Discussion leader: E. E. Woodliff, Foundry Sand Service Engineering Co., Detroit.

Tuesday, April 24

8:30 a.m.—Registration opens.

9 a.m.—Symposium on Principles of Gating
Presiding—R. F. Thomson, Research Laboratories Division, General Motors Corp., Detroit. Co-chairmen—W. E. Sicha, Aluminum Co. of America, Cleveland; G. P. Halliwell, H. Kramer & Co., Chicago; F. J. Walls, International Nickel Co., Detroit; R. P. Schauss, Illinois Clay Products Co., Chicago; W. S. Pellini, Naval Research Laboratory, Washington.
Tentative Design of Horizontal Gating Systems for Light Alloys—L. W. Eastwood, Battelle Memorial Institute, Columbus, O.
Relation of Casting Quality to Gating Practice—W. H. Johnson, H. F. Bishop and W. S. Pellini, Naval Research Laboratory, Washington.
Considerations in the Feeding of Castings—A. K. Higgins, Allis-Chalmers Mfg. Co., Milwaukee.
Interim Report on Gray Iron Risering Research—H. F. Taylor and W. A. Schmidt, Massachusetts Institute of Technology, Cambridge, Mass.

12 Noon—Malleable Roundtable Luncheon
Presiding—J. H. Lansing, Malleable Founders' Society, Cleveland. Co-chairmen—R. J. Anderson, Belle City Malleable Iron Co., Racine, Wis., G. Boli, Northern Malleable Iron Co., St. Paul.
Panel Discussions—*Malleable Foundry Refractories, Experimental Work on Core and Mold Materials.* Discussion leader: Wm. Ferrell, Auto Specialties Mfg. Co., St. Joseph, Mich.

2 p.m.—Symposium on Principles of Gating
Presiding—R. F. Thomson, Research Laboratories Division, General Motors Corp., Detroit. Co-chairmen—W. E. Sicha, Aluminum Co. of America, Cleveland; G. P. Halliwell, H. Kramer & Co., Chicago; F. J. Walls, International Nickel Co., Detroit; R. P. Schauss, Illinois Clay Products Co., Chicago; W. S. Pellini, Naval Research Laboratory, Washington.
Aluminum and Magnesium Division—Discussion by T. E. Kramer, Wm. F. Jobbins Inc., Aurora, Ill.
Steel Division—Discussion by J. B. Caine, foundry consultant, Cincinnati, and J. H. Lowe, Wehr Steel Co., Milwaukee.
Brass and Bronze Division—Discussion by B. N. Ames, N. Y. Naval Shipyard, Brooklyn, and W. W. Edens, Badger Brass & Aluminum Foundry Co., Milwaukee.
Gray Iron Division—*The Why of Gate and Feeder Design*—F. G. Sefing, International Nickel Co., New York. Discussion by H. H. Kessler, Sorbo-Mat Process Engineers, St. Louis, Mo.
Malleable Division—*Trends in Malleable Gating & Risering*—E. C. Zirzow, Deere & Co., Moline, Ill. *Developments in Gating of Small to Medium Malleable Castings*—C. C. Lawson, Wagner Malleable Iron Co., Decatur, Ill.

4 p.m. (A)—Pattern Session

4 p.m. (B)—Sand Session
Presiding—J. B. Caine, foundry consultant, Cincinnati. Co-chairman—R. H. Jacoby, the Key Co., E. St. Louis, Ill.
Compaction Studies of Molding Sands—R. E. Grim and W. D. Johns, Jr., State Geological Survey, University of Illinois, Urbana.
Effect of Sand Grain Distribution on Casting Finish—H. H. Fairfield and James MacConachie, Wm. Kennedy & Sons Ltd., Owen Sound, Ont.

4 p.m. (C)—Time Study and Methods Session
Presiding—M. T. Sell, Sterling Foundry Co., Wellington, O. Co-chairman—H. R. Williams, Williams Management Engineering, Milwaukee.
Fatigue Data Summary, Report No. 2—M. E. Annich, American Brake Shoe Co., Mahwah, N. J.

5:30 p.m.—Registration closes.

7 p.m.—Canadian Dinner
Presiding—J. J. McFayden, Galt Malleable Iron Co., Galt Ont., Canada

8 p.m. (A)—Brass and Bronze Sand Course
Presiding—J. R. Crain, American Brake Shoe Co., Na-

tional Bearing Division, Meadville, Pa.

Basic Approach to Sand Control for Copper Base Alloys—Part II—Hot and Retained Properties. Discussion leader: H. W. Dietert, Harry W. Dietert Co., Detroit.

8 p.m. (B)—Gray Iron Shop Course
Presiding—H. H. Wilder, Vanadium Corp. of America, Detroit. Co-chairman—E. J. Burke, Hanna Furnace Co., Buffalo.

Melting Gray Iron in a Reverberatory-Type Furnace. Discussion leader: J. G. Winget, Reda Pump Co., Bartlesville, Okla.

8 p.m. (C)—Sand Shop Course
Presiding—R. H. Olmsted, Whitehead Bros. Co., New York. Co-chairman—E. J. Bush, U. S. Naval Gun Factory, Washington.

Shell Molding and Use of Resin Binders. Discussion leaders—B. N. Ames, New York Naval Shipyard, Brooklyn, and W. C. Jeffery, Production Foundries Division, Jackson Industries, Birmingham.

● Wednesday, April 25

9 a.m.—Registration opens.

10 a.m. (A)—Brass and Bronze Session

10 a.m. (B)—Foundry Cost Session
Presiding—R. L. Lee, Grede Foundries Inc., Milwaukee.

'Spec' Sheets and their Various Uses—John Taylor, Lester B. Knight & Associates Inc., Chicago.

A New Method of Evaluating Costs in Jobbing Foundries—A. W. Schneble Jr., Advance Foundry Co., Dayton, O. and C. E. McQuiston, Ohio State University, Columbus, O.

10 a.m. (C)—Gray Iron Session
Presiding—A. P. Gagnebin, International Nickel Co., New York. Co-chairmen—T. E. Eagan, Cooper-Bessemer Corp., Grove City, Pa., and W. B. McFerrin, Haynes Stellite Division, Kokomo, Ind.

Influence of Silicon Content on Mechanical and High-Temperature Properties of Nodular Cast Iron—W. H. White, Jackson Iron & Steel Co., Jackson, O., L. P. Rice and A. R. Elsea, Battelle Memorial Institute, Columbus, O.

Effect of Phosphorus Content on Mechanical Properties of a Nodular Cast Iron—J. E. Rehder, Dept. of Mines and Technical Surveys, Ottawa, Canada.

Some Effects of Temperature and Melting Variables on Chemical Composition and Structure of Gray Irons—E. A. Lange and R. W. Heine, University of Wisconsin, Madison, Wis.

10 a.m. (D)—Sand Session
Presiding—J. H. Lowe, Wehr Steel Co., Milwaukee. Co-chairman—J. A. Rassenfoss, American Steel Foundries, East Chicago, Ind.

Metal Penetration—Report, Mold Surface Committee—S. L. Gertsman and A. E. Murton, Dept. of Mines and Technical Surveys, Ottawa, Canada.

The Determination of Metal Penetration in Sand Molds—Gonya and D. C. Ekey, Ohio State University, Columbus, O.

Effect of Fluid Metal Pressure on Penetration Defects—Progress Report—C. C. Sigerfoos, Michigan State College, East Lansing, Mich.

12 Noon (A)—Pattern Roundtable Luncheon

12 Noon (B)—Defense Production Luncheon

2 p.m.—Annual Business Meeting
Presiding—W. L. Woody, AFS president, National Malleable & Steel Castings Co., Cleveland.
President's annual address
Apprentice contest awards
Election of officers and directors

2:45 p.m.—Charles Edgar Hoyt Annual Lecture
The Management of Industrial Research—James C. Zeder, Director of Engineering and Research, Chrysler Corp., Detroit.

4 p.m. (A)—Plant and Plant Equipment Session
Presiding—James Thomson, Continental Foundry & Machine Co., East Chicago, Ind. Co-chairman—H. W. Johnson, Wells Mfg. Co., Skokie, Ill.

Equipment and Methods of Straightening and Dimensional Inspection of Malleable Iron Castings—L. N. Schuman, National Malleable & Steel Castings Co., Cleveland.

Dimensional Checking and Pressure Testing of Gray Iron Castings—K. M. Smith, Caterpillar Tractor Co., Peoria, Ill.

4 p.m. (B)—Refractories Session
Presiding—R. H. Stone, Vesuvius Crucible Co., Pittsburgh.

Ladle Refractories and Practice in Acid Electric Steel Foundry—Clyde Wyman, Burnside Steel Foundry Co., Chicago. (General Discussion of ladle refractories and their application)

4 p.m. (C)—Sand Session
Presiding—E. C. Zirzow, Deere & Co., Moline, Ill. Co-chairman—H. K. Salzberg, the Borden Co., Bainbridge, N. Y.

Some Notes on Core Oil Testing—A. E. Murton, Dept. of Mines and Technical Surveys, Ottawa; H. H. Fairfield, Wm. Kennedy & Sons, Ltd., Owen Sound, Ont., and B. Richardson, Steel Castings Institute of Canada, Ottawa.

Recent Advances in Dielectric Core Baking—J. W. Cable, Thermex Division, Girdler Corp., Louisville, Ky.

5:30 p.m.—Registration closes.

7: p.m.—AFS Alumni Dinner

(By invitation only)

8 p.m. (A)—Plant and Plant Equipment Session
(Sponsored by Plant and Plant Equipment Committee)
Presiding—James Thomson, Continental Foundry & Machine Co., East Chicago, Ind. Co-chairman—K. M. Smith, Caterpillar Tractor Co., Peoria, Ill.

Choosing Equipment for Nondestructive Testing—C. H. Hastings, Watertown Arsenal, Mass.

Motion picture—*Mechanization in Molding*—H. C. Weimer, Beardsley & Piper Division, Pettibone Mulliken Corp., Chicago.

8 p.m. (B)—Gray Iron Shop Course

Assembly Room

Presiding—H. K. Priestley, Vassar Electroloy Products, Inc., Vassar, Mich. Co-chairman—E. J. Burke, Hanna Furnace Co., Buffalo.

Metal Pouring Temperature Control. Discussion leader: R. A. Clark, Electro Metallurgical Division, Union Carbide & Carbon Co., Detroit.

8 p.m. (C)—Sand Shop Course
Presiding—R. H. Jacoby, the Key Co., East St. Louis, Ill. Co-chairman—H. W. Meyer, General Steel Castings Corp., Granite City, Ill.

Foundry Sand Control. Discussion leader: C. B. Schureman, Baroid Sales Division, National Lead Co., Chicago.

● Thursday, April 26

9 a.m.—Registration opens.

10 a.m. (A)—Gray Iron Session
Presiding — Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va. Co-chairman—Gosta Vennerholm, Ford Motor Co., Dearborn, Mich.

Basic Cupola Melting and Its Possibilities—Official Exchange Paper from the Institute of British Foundrymen—E. S. Renshaw, Ford Motor Co. Ltd., Dagenham, England.

Effect of Slag Analysis on Cupola Operation—R. A. Flinn, American Brake Shoe Co., Mahwah, N. J.

10 a.m. (B)—Steel Session

Presiding—J. A. Rassenfoss, American Steel Foundries, East Chicago, Ind. Co-chairman—H. W. Dietert, Harry W. Dietert Co., Detroit.

Precoat Materials for Investment Casting—W. F. Davenport and A. Strott, Wright-Patterson Air Field, Dayton, O.

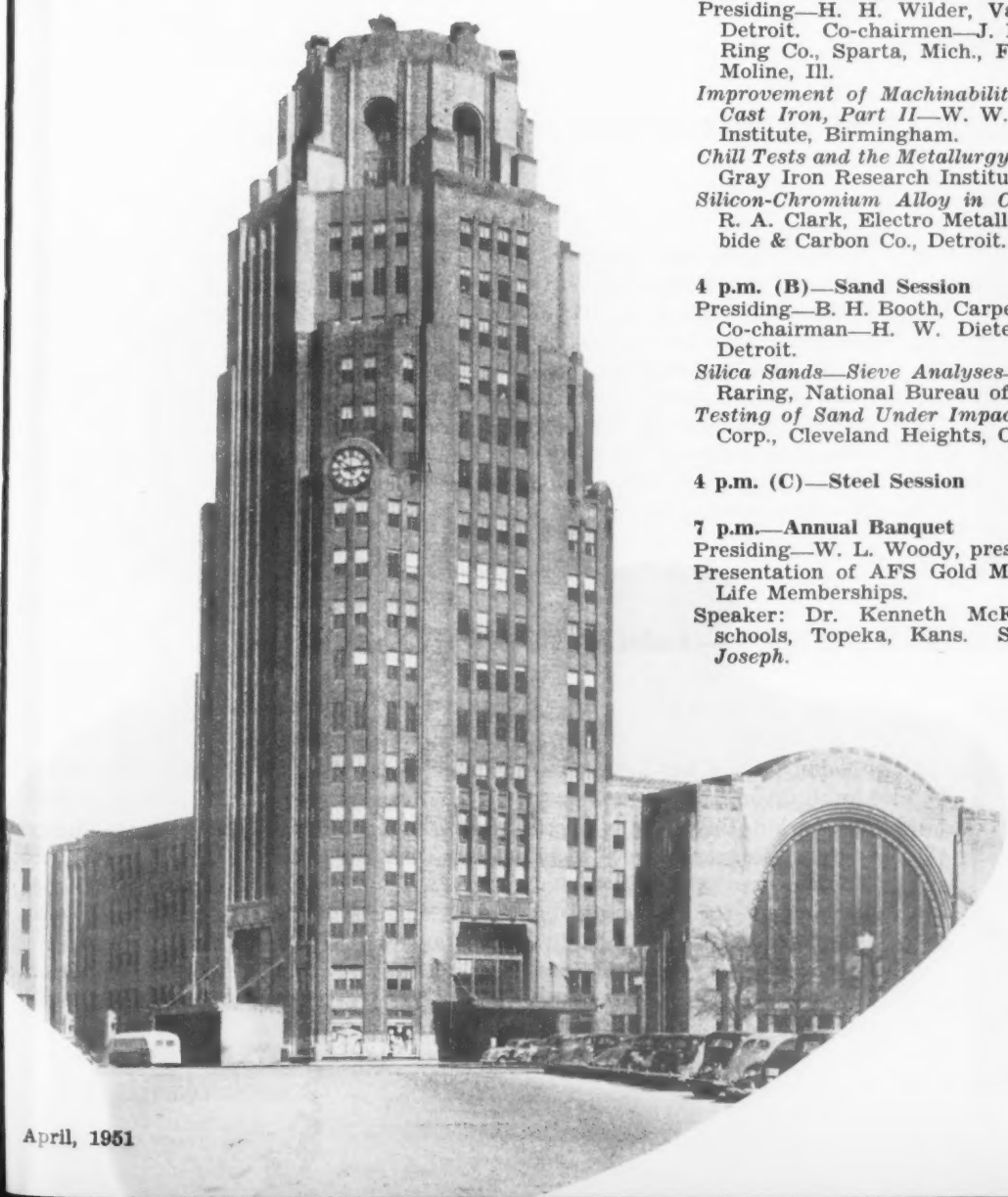
Contribution of Riser and Casting Edge Effects to Soundness of Cast Steel Plate—H. F. Bishop, E. T. Myskowski and W. S. Pellini, Naval Research Laboratory, Washington.

An Investigation of the Penetration of Steel Into Molding Sands—Official Exchange Paper from Metallografiska Institute—Holger Pettersson, Stockholm, Sweden. To be presented by J. A. Rassenfoss, American Steel Foundries, East Chicago, Ind.

12 Noon—Gray Iron Roundtable Luncheon

Chairman—A. D. Barczak, Superior Foundry Inc., Cleveland. Co-chairman—C. A. Harmon, Hanna Furnace Corp., Buffalo.

Gray Iron Melting with Materials Available—Discussion leaders: J. F. Dobbs, New York Air Brake Co., Watertown, N. Y., S. A. Kundrat, Homestead Valve Mfg. Co., Coraopolis, Pa.



12 Noon—Steel Roundtable Luncheon

Presiding—V. E. Zang, Unitcast Corp., Toledo. Co-chairman—D. E. Sawtelle, Malleable Iron Fittings Co., Branford, Conn.

Subjects: *Alloy Substitutions and Conversion—Increasing Casting and Total Yield—Sulphur—Acid vs Basic Practice.*

2 p.m. (A)—Gray Iron Session

Presiding—V. A. Crosby, Climax Molybdenum Co., Detroit. Co-chairman—Richard Schneidewind, University of Michigan, Ann Arbor.

Structure and Mechanical Properties of a Mo-Ni-Cr Cast Iron—A. E. Loria, formerly with Mellon Institute of Industrial Research, Pittsburgh; presently with the Carborundum Co., Niagara Falls, N. Y.

Kinetics of Graphitization in Cast Irons—B. F. Brown and M. F. Hawkes, North Carolina State College of Agriculture and Engineering, of the University of North Carolina, Raleigh, N. C.

Isothermal Transformation Characteristics on Direct Cooling of Alloyed White Iron—F. B. Rote and G. A. Conger, University of Michigan, Ann Arbor, and K. A. DeLonge, International Nickel Co., Bayonne, N. J.

2 p.m. (B)—Steel Session

Presiding—F. Kiper, Ohio Steel Foundry Co., Springfield, O. Co-chairman—G. W. Johnson, Vanadium Corp. of America, Chicago.

Effect of Vanadium on Properties of Cast Chromium-Molybdenum Steels—N. A. Ziegler, W. L. Meinhart and J. R. Goldsmith, Crane Co., Chicago.

Usefulness and Ill Effects of Gases in Metallurgy—E. Spire, Canadian Liquid Air Co. Ltd., Montreal, Canada.

4 p.m. (A)—Gray Iron Session

Presiding—H. H. Wilder, Vanadium Corp. of America, Detroit. Co-chairmen—J. L. Brooks, Muskegon Piston Ring Co., Sparta, Mich., F. T. McGuire, Deere & Co., Moline, Ill.

Improvement of Machinability in High-Phosphorus Gray Cast Iron, Part II—W. W. Austin, Southern Research Institute, Birmingham.

Chill Tests and the Metallurgy of Gray Iron—D. E. Krause, Gray Iron Research Institute, Columbus, O.

Silicon-Chromium Alloy in Complicated Iron Castings—R. A. Clark, Electro Metallurgical Division, Union Carbide & Carbon Co., Detroit.

4 p.m. (B)—Sand Session

Presiding—B. H. Booth, Carpenter Bros., Inc., Milwaukee. Co-chairman—H. W. Dietert, Harry W. Dietert Co., Detroit.

Silica Sands—Sieve Analyses—A. I. Krynitsky and F. W. Raring, National Bureau of Standards, Washington.

Testing of Sand Under Impact—W. H. Moore, Meehanite Corp., Cleveland Heights, O.

4 p.m. (C)—Steel Session

7 p.m.—Annual Banquet

Presiding—W. L. Woody, president, AFS.

Presentation of AFS Gold Medal Awards and Honorary Life Memberships.

Speaker: Dr. Kenneth McFarland, superintendent of schools, Topeka, Kans. Subject: *Which Knew Not Joseph.*

Six Recipients Named for AFS Awards

VICTOR A. CROSBY—*John A. Penton Medalist*

Mr. Crosby's "outstanding service to the AFS and his contributions to the dissemination of information relating to ferrous foundry metallurgy" are being recognized through the award of the John A. Penton gold medal. Associated with Climax Molybdenum Co., Detroit, since 1934, Mr. Crosby is metallurgical engineer in charge of sales, service and development. He is a graduate of the University of Mississippi, and prior to joining Climax, served in the chemical or metallurgical departments of Dodge Bros. Co., Packard Motor Car Co. and Studebaker Corp. Mr. Crosby is chairman of the AFS Gray Iron Division and is a past chairman of the Detroit Chapter.

THOMAS W. CURRY—*Peter L. Simpson Medalist*

Mr. Curry, plant metallurgist of Lynchburg Foundry Co., Lynchburg, Va., has been chosen to receive the Peter L. Simpson gold medal "for his outstanding work and contributions in the field of sand technology in the foundry industry." Mr. Curry was graduated from Pennsylvania State College in 1932 and was associated alternately during the following 11 years in the foundry departments of the Kennedy Van Saun Mfg. Corp., Danville, Pa., and the York Corp., York, Pa. Mr. Curry has been with the Lynchburg company since 1943 and in recent years has pioneered the use of resin binders in core sand mixtures and development of chemical treatments for molding sands.

ALFRED BOYLES—*John H. Whiting Medalist*

Mr. Boyles has been chosen to receive the John H. Whiting Gold Medal "for fundamental studies on the mechanism of graphitization of gray cast iron." Mr. Boyles is a specialist in fundamental research in metallurgy and metallography and is associated with the research and development department of the United States Pipe & Foundry Co., Burlington, N. J. A graduate of the University of North Carolina, Mr. Boyles has served with Tennessee Coal, Iron & Railroad Co. and with Battelle Memorial Institute in metallurgical research capacities. He is active in the AFS Gray Iron Division, serving as a member of its Heat Treatment, Microstructure and Research committees.

Board of Awards of the American Foundrymen's Society has selected six prominent foundrymen as 1951 recipients of gold medal and honorary life membership awards. The presentations will be made at the annual banquet to be held in Buffalo Thursday evening, Apr. 26, during the society's 55th annual convention

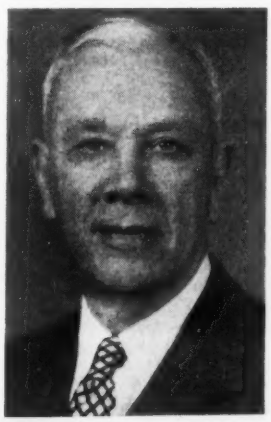
EDWARD W. BEACH—*Honorary Life Member*

Mr. Beach, who retired last year from Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., is being recognized "for outstanding contributions in the field of foundry engineering" through the award of an honorary life membership. He served an apprenticeship at Waterbury Farrel Foundry & Machine Co., and in 1901 organized the Manufacturers Foundry Co., one of the first to devote its entire output to the automotive industry. In 1903 Mr. Beach first applied mechanization to foundry production by placing a cylinder pattern on a molding machine for mass production. He has served as president of Ferro Machine & Foundry Co., Cleveland, and as vice president, Warren Foundry Co., Warren, O. He joined CWC in 1927.

EDWARD J. McAFEE—*Honorary Life Member*

Mr. McAfee, master patternmaker with the Puget Sound Naval Shipyard, Bremerton, Wash., will receive an honorary life membership in recognition "of his outstanding service to the foundry industry in the development of patternmaking materials and applications." In 1949 Mr. McAfee was awarded the Navy's meritorious civilian award for his development of new patternmaking methods which had contributed to the U. S. war effort. He started his career as a patternmaker in 1907 with the Portland Iron Works, Portland, Oreg., and joined the shipyard in 1916. He was made a supervisor a year later and master patternmaker in 1938. Mr. McAfee is co-author of the *Patternmakers' Manual.*

WALTON L. WOODY—*Honorary Life Member*



Mr. Woody, in accordance with the custom of the society, will be awarded an honorary life membership upon completion of his term as president. Mr. Woody has long been prominent in AFS activities, serving as first president of the Northeastern Ohio Chapter, as a national director for three years and as a member of various committees of the Malleable Division. He joined the National Malleable & Steel Castings Co. following graduation from Rose Polytechnic Institute, Terre Haute, Ind., in 1914, and has served at its Indianapolis, Sharon, Pa., Melrose Park, Ill., and Cleveland plants. Mr. Woody was named vice president in charge of operations in 1943.

Western Ne

Niagara Square, Buffalo

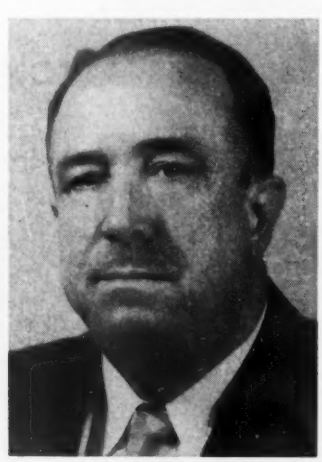
ALFRED A. DIEBOLD
Chairman
General Committee

MARVE TAUBLIEB
Chairman
Publicity Committee

JOSEPH H. SANDER
Chairman
Plant Visitation Committee

OTTO V. GUENTHER
Chairman
Shop Course Committee

JOSEPH ZAHM
Chairman
Membership Committee



A. J. HEYSEL
Chairman
Banquet Committee

Niagara Chapter *Committee Members*

ERWIN W. DEUTSCHLANDER
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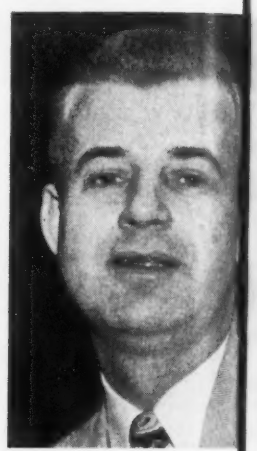

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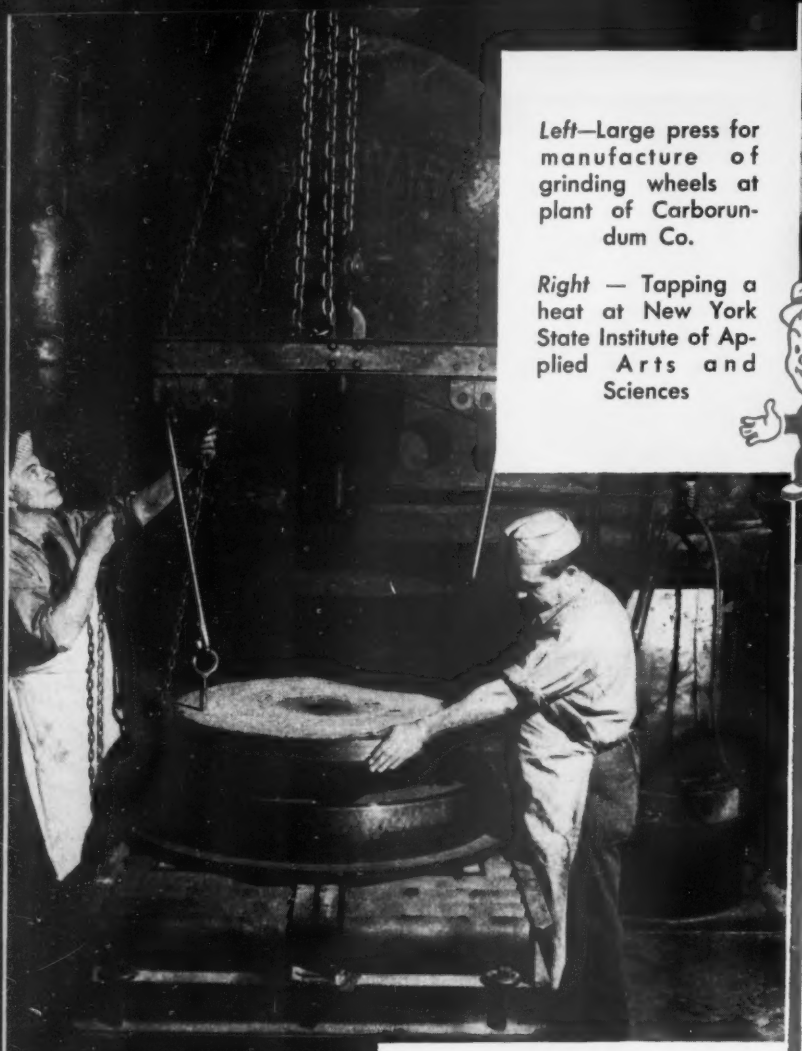


Left—Large press for manufacture of grinding wheels at plant of Carborundum Co.

Right — Tapping a heat at New York State Institute of Applied Arts and Sciences

PLANT VISITATION SCHEDULE

American Radiator & Standard Sanitary Corp.
8:45 a.m. to 10:15 a.m. and 11:15 a.m. to 12:15 p.m., Monday through Thursday

Bison Castings Inc.
10 to 12 a.m. and 2 to 4 p.m., Monday through Thursday

Blaw-Knox Co., Buflovak Equipment Division
10 to 12 a.m. and 2 to 4 p.m., Monday through Thursday

Carborundum Co., Niagara Falls, N. Y.
Time and dates to be announced

Kencroft Malleable Co.
10 to 12 p.m., Tuesday and Thursday

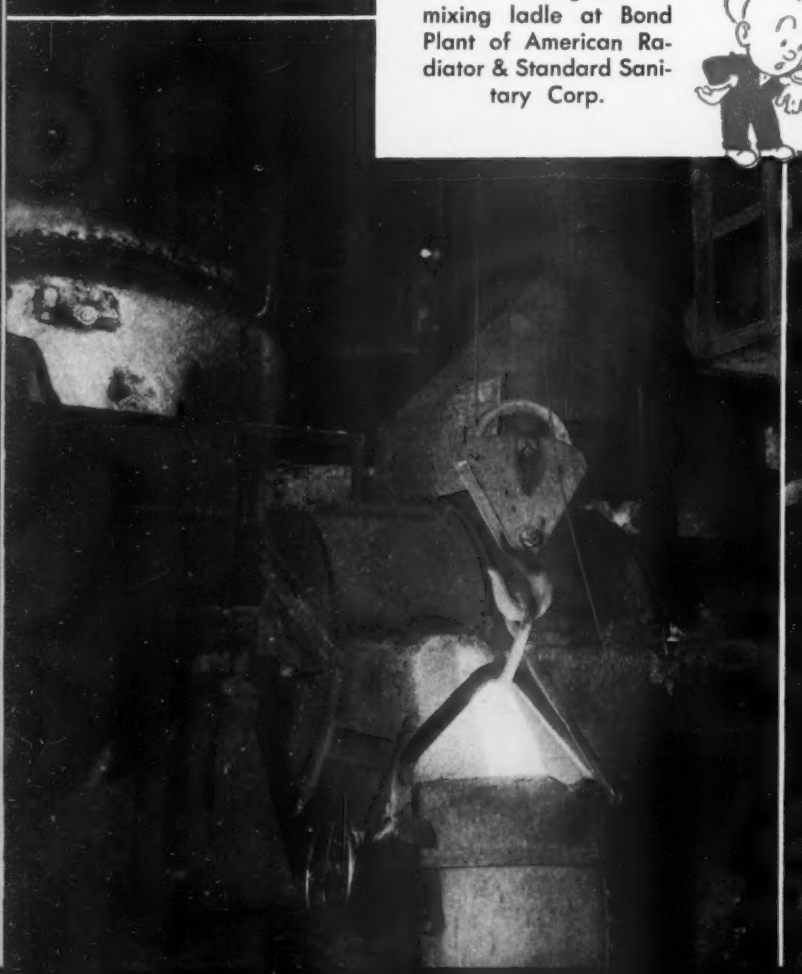
New York State Institute
10 to 12 a.m. and 2 to 4 p.m., Monday through Thursday

Pratt & Letchworth Co.
10 to 12 a.m. and 2 to 4 p.m., Monday through Thursday

Symington-Gould Corp.
10 to 12 a.m. and 2 to 4 p.m., Monday through Thursday

Tonawanda Iron Division, American-Standard
10 to 12 a.m. and 2 to 4 p.m., Monday through Thursday

Worthington Pump & Machinery Corp.
10 to 12 a.m. and 2 to 4 p.m., Monday through Thursday



Below—Pouring from a mixing ladle at Bond Plant of American Radiator & Standard Sanitary Corp.

PLANT VISITATIONS *at Buffalo*

VARIOUS plants in the Buffalo area will be open for inspection by visitors during the AFS convention there, Apr. 23-26. Most of these plants may be visited in either the morning or afternoon of each of the four days. Western New York Chapter has a committee in charge of arrangements for plant inspection and will assist convention visitors planning tours of local industry.

The chapter's Plant Visitation Committee is headed by Joseph H. Sander, Tonawanda Electric Steel Casting Corp., North Tonawanda, N. Y. Co-chairmen are Walter Hunsicker, Worthington Pump & Machinery Corp., and Robert Bruce, Blaw-Knox Co., Buflovak Equipment Division.

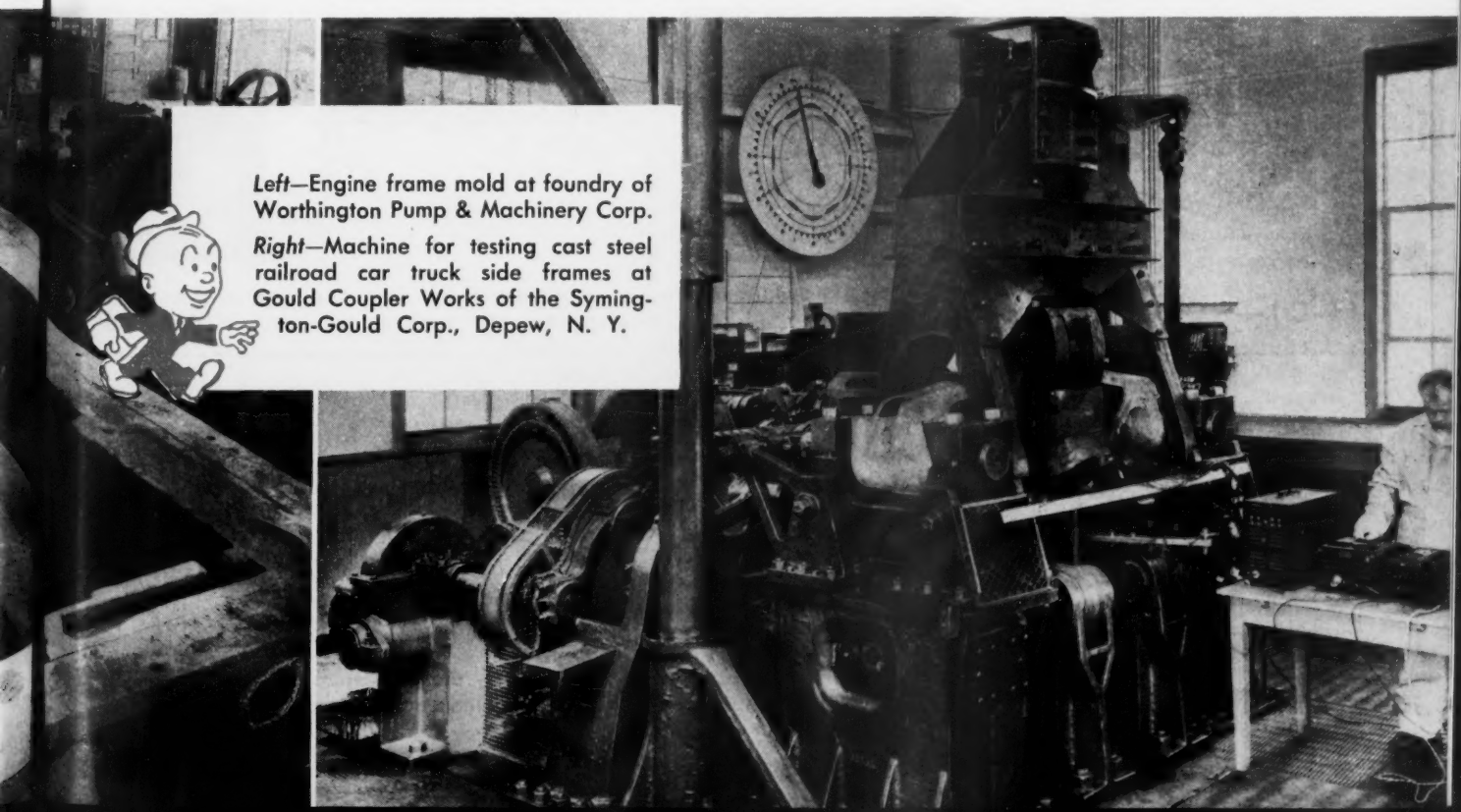
As indicated in the accompanying schedule, plants available for inspection include not only foundries but also blast furnaces and the Carborundum Co.'s operations in abrasive products manufacture at Niagara Falls.

American Radiator & Standard Sanitary Corp. will be host at both its Bond Plant at Buffalo and its Tonawanda Iron Division at North Tonawanda, N. Y. The Bond plant manufactures low pressure cast iron boilers and is the largest American-Standard plant for the production of heating equipment. It includes two principal foundry buidings, one for plate and one for cored castings. Each has a continuous molding system production line. Cupola melting capacity is 520 tons of iron a day.

Another large producer of gray iron castings on the visitation schedule is Worthington Pump & Machinery Corp. Among the major items made by this company are large gas engines and pumps; an accompanying illustration shows a mold for one of these engine frame castings. The casting requires 60,000 lb of molten metal, and the mold is poured in approximately two minutes.

Other gray iron foundries open for inspection include Bison Castings Inc. and Blaw-Knox Co., Buflovak Equipment Division. Steel foundries are the Pratt & Letchworth Co. and the Symington-Gould Corp., while malleable iron operations may be seen at Kencroft Malleable Co.

The New York State (*Please turn to page* 159)



Left—Engine frame mold at foundry of Worthington Pump & Machinery Corp.

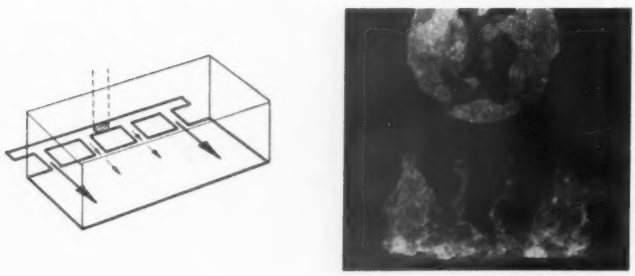
Right—Machine for testing cast steel railroad car truck side frames at Gould Coupler Works of the Symington-Gould Corp., Depew, N. Y.

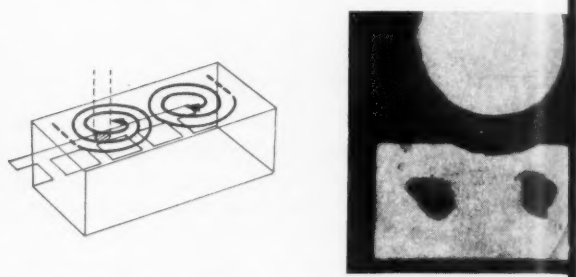
By W. H. JOHNSON, H. F. BISHOP
Metallurgists
and W. S. PELLINI
Head
Metal Processing Branch, Metallurgy Division
Naval Research Laboratory, Washington

CHOKE CONTROL I

CONDITIONS OF MOLD TURBULENCE

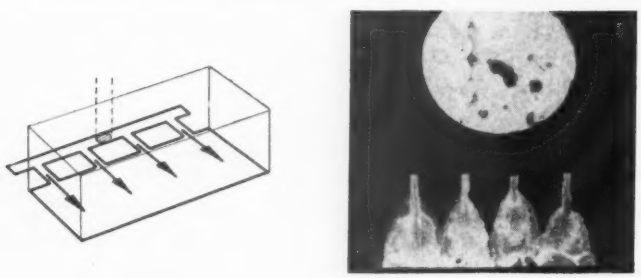
Initial Flow Patterns from Various Gates — *Intermediate and Late Stage Flow Patter*

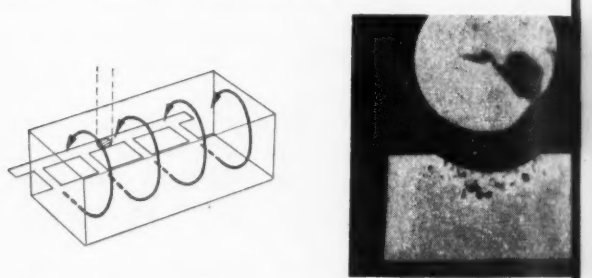




(1-A)—SWIRLING

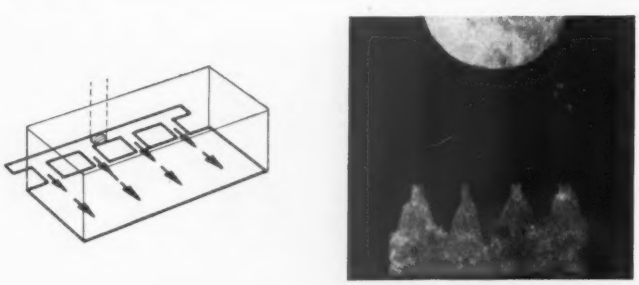
Swirling is caused by nonuniform flow. The axis of rotation is perpendicular to the surfaces of the metal and to the plane of the fingers

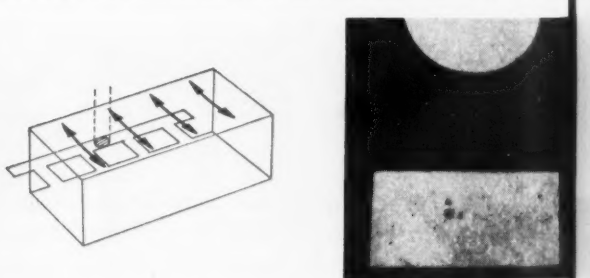




(1-B)—ROLLING

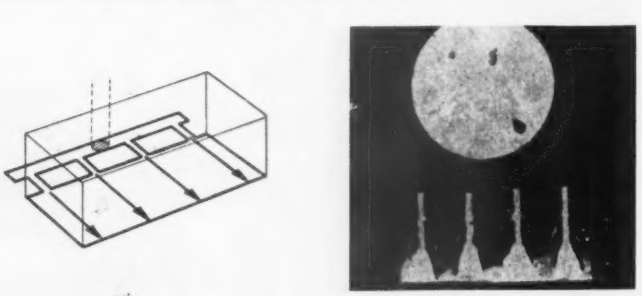
Rolling is produced by uniform flow. The axis of rotation of metal within the mold is horizontal and parallel to the plane of the finger

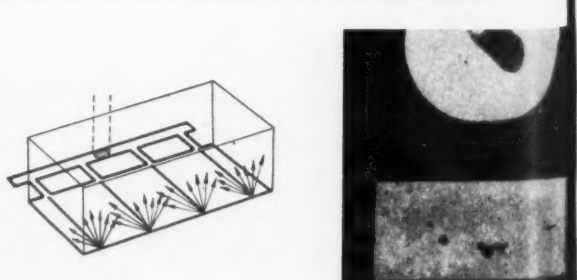




(1-C)—ROCKING

Rocking is produced by an intermittent flow discharge and is characterized by a rocking back and forth of the metal in the mold



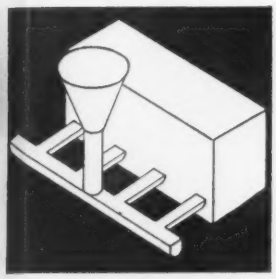


(1-D)—IRREGULAR

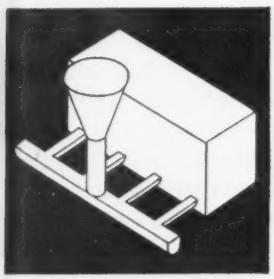
Irregular condition is produced by the high entrance velocities which cause a localized disturbance around each jet issuing from the fingers

Finger Gating

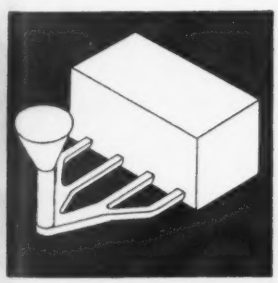
Gating System Producing
ttern Indicated Flow Conditions



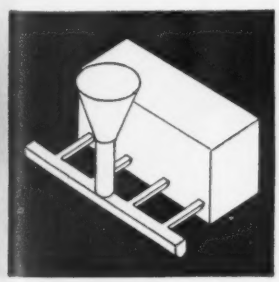
Gating System
SA—FA = 1—2



Gating System
SA—FA = 1—1



Gating System
SA—FA = 1—2



Gating System
SA—FA = 1—≦½

Various designs of finger gating systems were studied by the authors to evolve general principles of choke control for multiple finger gating systems. In a free or nonchoked system the metal follows preferential paths dictated by the inertia of the metal stream and geometry of the gating system, resulting in nonuniform flow. It was found that if a choke condition is developed at the finger inlets, the gating system becomes pressurized and forced, and uniform flow occurs from all fingers regardless of position.

The geometric shape of the fingers has been shown to be of secondary importance to choke control. Fingers which provide high frictional resistance to flow add to the choking effect and thus require less than normal geometric choking to produce pressurization. The relationships between geometric and hydraulic choked conditions are demonstrated.

IT IS generally considered that the smooth, uniform introduction of liquid metal into the casting cavity is not only desirable but often of primary importance to casting quality. To realize such desirable features of metal flow requires knowledge of the relationships between gating design and flow conditions. Such information has not been available in the past, so gating systems were necessarily developed by purely empirical practices and without direct knowledge that correct functioning was obtained.

It was apparent from the earlier investigations[1] conducted at the Naval Research Laboratory that metal, flowing freely in a runner, does not necessarily enter all channels which are a part of the gating system, but may continue along preferential straight-line paths, ignoring side channels and openings. A later report[2] and film[3] showed that uniform flow may be obtained in "free" or nonchoking finger gate systems by (1) elimination of pronounced momentum-pressure effects by the use of enlargements, and (2) control of momentum-pressure effects by means of sharp angles, constrictions or increased flow distance.

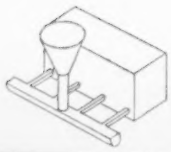
The present report deals with an alternative method of obtaining uniform flow by choking or pressurization of the fingers in the gating system. These studies of choke control are based, as in previous investigations, on the observations of the discharge of molten steel into the mold cavities as recorded by motion photography. The most instructive scenes have been assembled into a 16-mm colored sound film, "Choke Control in Finger Gating."

The effects of choke control were observed with varying (1) runner diameters, (2) finger diameters, (3) finger geometries and (4) finger lengths. Four different finger geometries were included: (1) flared (smallest dimension at runner); (2) tapered (smallest dimension at casting); (3) streamlined; and (4) rectangular.

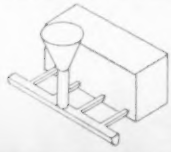
Area ratios were taken as the relative areas of cross section available to metal flow. Thus the sprue area is that of the sprue cross section. If the sprue is at the center the runner area must be considered as twice the runner cross section since the stream splits into two channels. If, however, the sprue is located on the end of the runner, the runner area then is that of the runner cross section. The finger area is the total cross-sectional area of all four fingers, or four times the area of a single finger.

Area ratios of sprue to runner or sprue to finger are described as geometric-

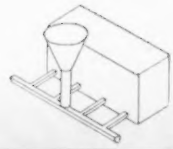
RUNNER SIZE VARIATIONS



(2-A)
RA–FA = 2–1



(2-B)
RA–FA = 1–1



(2-C)
RA–FA = ½–

ally choked if the area ratios in the direction of flow equal one or less than one. In the discussions which follow it will be noted that systems of moderately choked geometry may or may not produce hydraulically choked conditions (pressurization) depending on certain shape factors. The attainment of a hydraulically choked condition which should theoretically produce uniform flow from all openings was evaluated by observations of the actual flow patterns produced by the system in question.

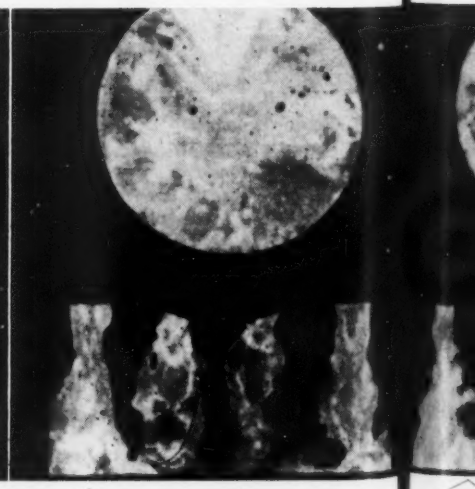
Experimental Procedure—Molten steel was poured at 3000° F into finger gating systems and the flow characteristics of the metal as it emerged from the gates were recorded by 16-mm Kodachrome cinephotography at 64 frames per second.

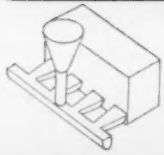
Unless noted otherwise the dimensions of the sprues and runners were 1 in. diam. The runner and fingers in each system were circular in cross section except for a slight squaring on the upper corners to facilitate molding. The runner-to-casting distance, or finger length, was 3 in. unless otherwise noted. The mold cavity was 6 x 12 x 6 in. A plugged pouring cup was used because previous work showed that its use increases the constancy of metal flow into the sprue.

Observations of Metal Flow—In a previous report it was shown that the type of mold turbulence developed by multiple finger gating depends on the relative flow volume from each of the fingers. Three types of mold turbulence were observed: Swirling, rolling and rocking. To these, as the result of the present investigation, is now added a fourth, termed "irregular", which is related to the velocity of the metal

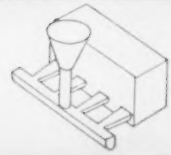
Finger Geometry Variations

FLARED FINGERS



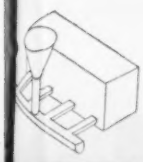


(4-A)
SA–FA = 1–2

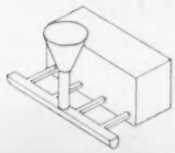


(4-B)
SA–FA = 1–1

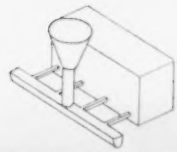
FINGER SIZE VARIATIONS



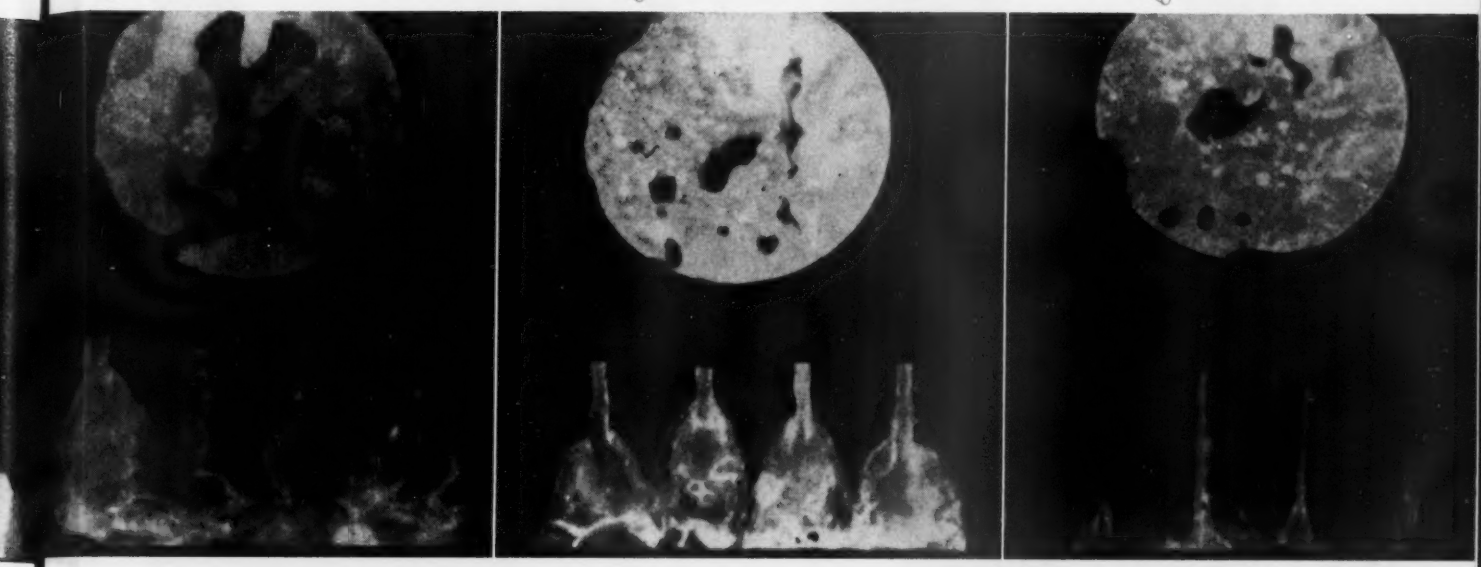
(3-A)
SA–FA = 1–2



(3-B)
SA–FA = 1–1



(3-C)
SA–FA = 1–¼

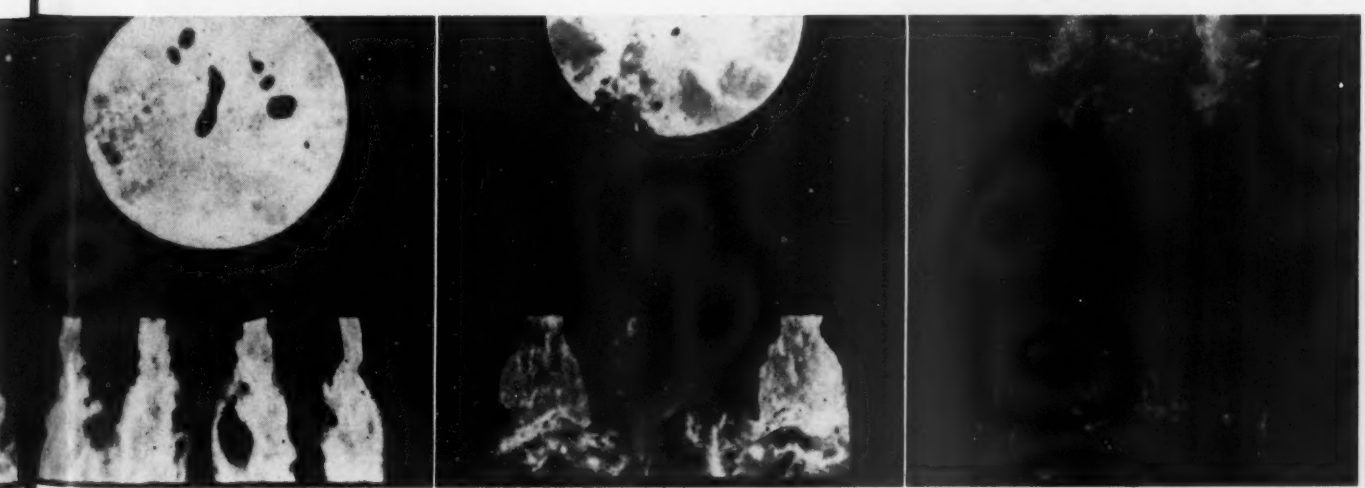


issuing from the fingers. The origin, mode of occurrence and appearance of these four types of turbulence is presented schematically in Fig. 1. In the descriptions that follow, flow patterns, during the early phases of pouring before the exit streams are covered, were determined directly from the photographs of the flow deltas. Flow patterns during late stages were deduced indirectly from the conditions of turbulence on the surface of the metal in the mold.

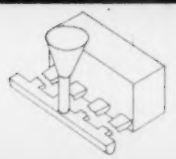
Effect of Runner Size—The gating systems of Fig. 2 show the effects of choke control by varying runner diameters. The sprue and finger diameters were retained constant at 1 and 0.5 in., respectively; consequently, the sprue-finger area ratio was always equal. The runner diameters studied were 1, 0.7 and 0.5 in., providing runner-finger area ratios (RA-FA) of 2-1, 1-1, and 1/2-1, respectively.

In the system with the runner 1 in. in diameter (RA-FA = 2-1), all of the fingers fed uniformly throughout pouring (Fig. 2A). In the second (R = 0.7-in. diameter, RA-FA = 1-1) a slight emphasis on flow from the outer fingers was noted in the beginning (Fig. 2B), but a short time later flow became uniform. The ½-in. diameter runner (RA-FA = ½-1) caused the outer fingers to feed strongly (Fig. 2C) which results in swirling; only near the very end of pouring did rolling turbulence start, indicating uniform flow.

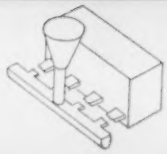
These tests indicate that if a pressure is established in the runner, uniform feeding from all fingers results. Pressurization must be obtained by geometric choking between the fingers and runner; viz.,



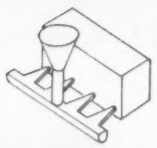
(4-C)
SA–FA = 1–½



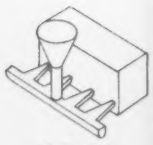
(4-D)
SA–FA = 1–2



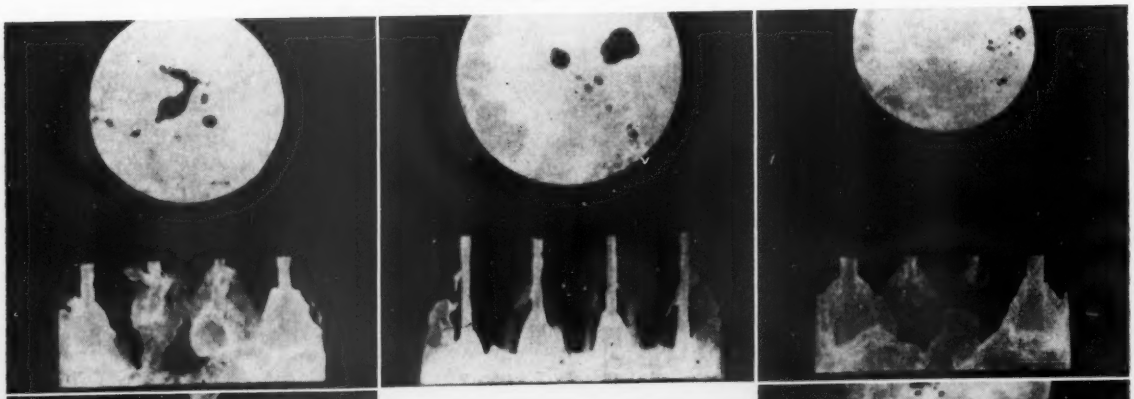
(4-E)
SA–FA = 1–1



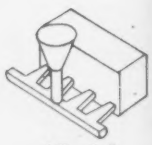
(5-C)
SA—FA
= 1—½



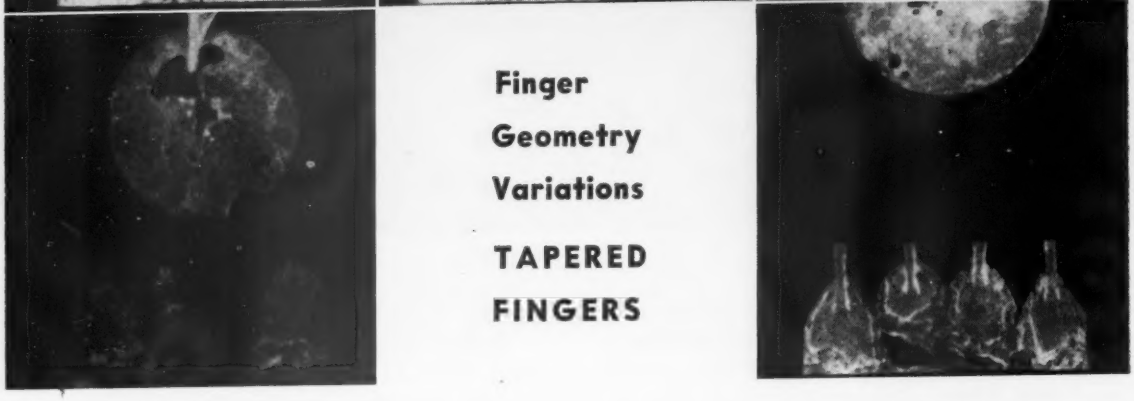
(5-B)
SA—FA
= 1—1



(5-D
SA—F
= 1—2

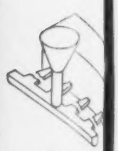


(5-A)
SA—FA
= 1—2

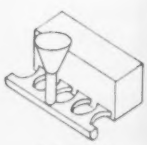


Finger Geometry Variations

TAPERED FINGERS



(5-E)
SA—F
= 1—1

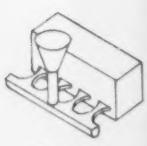


(6-A)
SA—FA
= 1—2

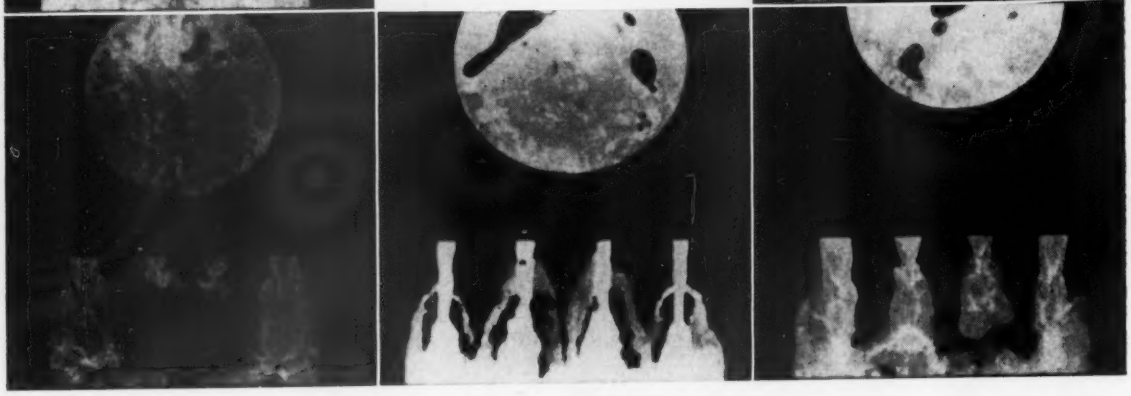
Finger Geometry Variations

STREAMLINED FINGERS

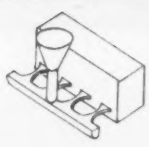
(6-D
SA—F
= 1—2



(6-B)
SA—FA
= 1—1



(6-E
SA—F
= 1—1



(6-C)
SA—FA
= 1—½

by providing a geometry such that the fingers cannot deliver as much metal as the runner can provide. This in turn requires a sprue sufficiently large to keep the runner full, for if this condition is not met, the runner is emptied with consequent loss of pressure and nonuniform flow from the fingers.

It is essential, therefore, to provide for sprue and runner areas at least as great as the finger areas as shown by the RA-FA = 1-1 systems. A somewhat larger runner area should be employed in practice to ensure that flow into the runner is unhindered. Thus, in evaluating the effect of variations in finger size and design in subsequent tests, runners having an area equal to twice the sprue area were used.

Effect of Finger Size—The gating systems in Fig. 3 illustrate choke control by variations in finger diameters. The diameters varied in ¼-in. steps as follows: 0.75, 0.5, 0.25 in. In each system the sprue-runner ratio was kept constant: SA-RA = 1-2. The sprue-finger area ratios thus varied as follows: SA-FA = 1-2, 1-1, and 1¼.

The first geometrically free system (F = 0.75-in. diam; SA-FA = 1-2) caused most of the steel to enter the mold through the outer fingers (Fig. 3A) producing swirling turbulence which persisted throughout pouring. In the second system (F = 0.5 in. diam; SA-FA = 1-1) which is just geometrically choking, all of the fingers fed uniformly, indicating a condition of hydraulic choking (Fig. 2B); rolling turbulence predominated. In the last system which is severely choked geometrically (F = 0.25-in. diam; SA-FA = 1¼) all of the fingers fed with complete uniformity (Fig. 2C), but with a very high entrance velocity; the streams hit the opposite wall, a distance of 6 in.

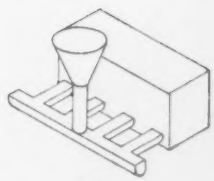
Irregular turbulence resulted from this jet effect and persisted during most of the pouring. A gating system consisting of straight simple elements will thus develop optimum pressure conditions when the sprue-to-runner-to-finger area ratios are 1 − >1 − 1. (Optimum pressure condition is defined as a condition of small pressure sufficient to develop uniform flow; pressures greater than this desired minimum act to cause jet flow.) Larger fingers result in free, unequal flow; smaller fingers cause extreme pressurization, and high entrance velocity which may harm the mold.

Effect of Finger Shape—In the first three groups representing flared, tapered and streamlined fingers, the finger areas were calculated from the smallest portions of the fingers. In all of the systems in this series the sprue-runner ratio was always one to two, SA − RA = 1-2, and the sprue-finger area ratios varied in three steps as follows: SA − FA = 1-2, 1-1 and 1-½.

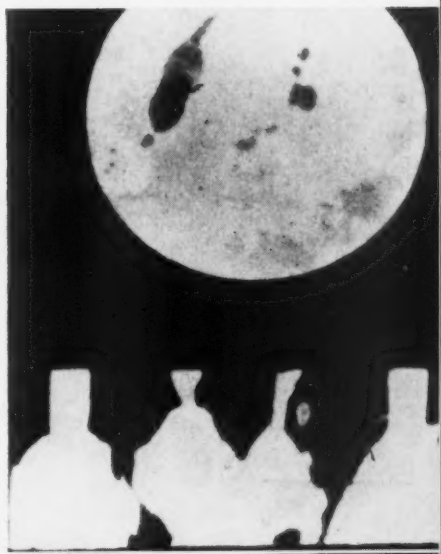
Flared Fingers—The first system studied, Fig. 4, had fingers which flared out from the runner, i.e., the smallest cross section of the fingers was at the runner and the enlarged portion at the mold cavity. Three finger diameters were used; 0.75, 0.5 and 0.375 in. The exit ends of the fingers were always 1½ in. in width and with a depth corresponding to the respective finger diameters.

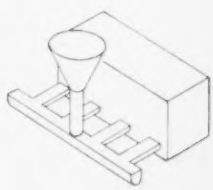
In the first system (F = 0.75-in. diam, SA − FA = 1-2) the outer fingers did (*Please turn to page* 275)

Finger Geometry Variations
RECTANGULAR FINGERS

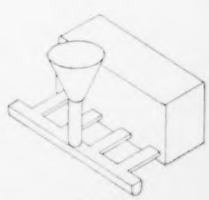


(7-A)
SA − FA = 1 − 2

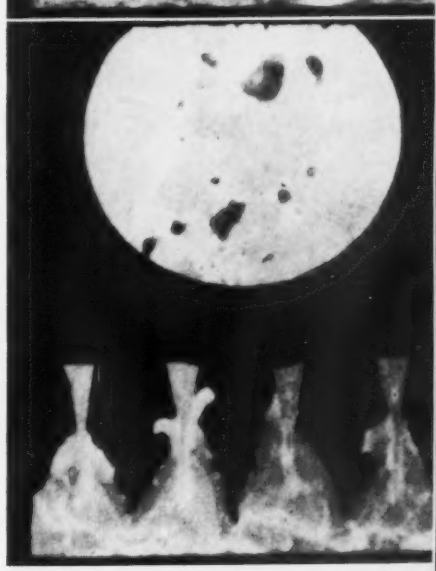




(7-B)
SA − FA = 1 − 1

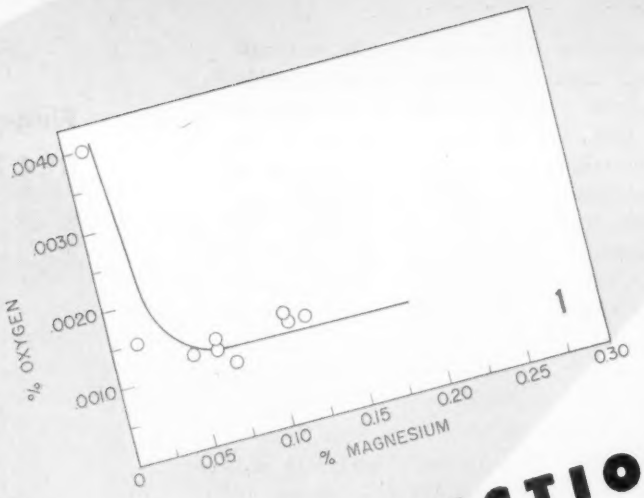


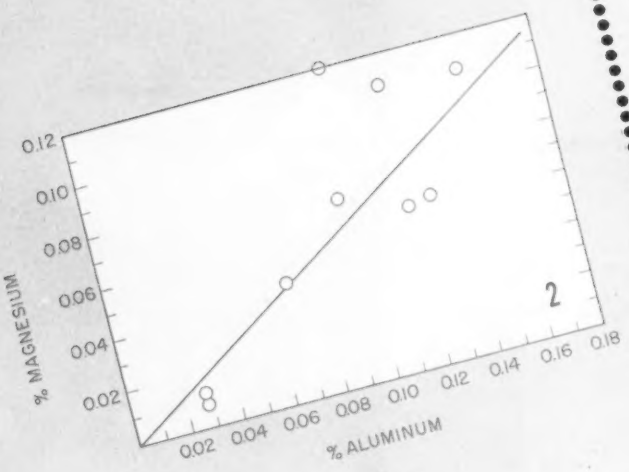
(7-C)
SA − FA = 1 − ½

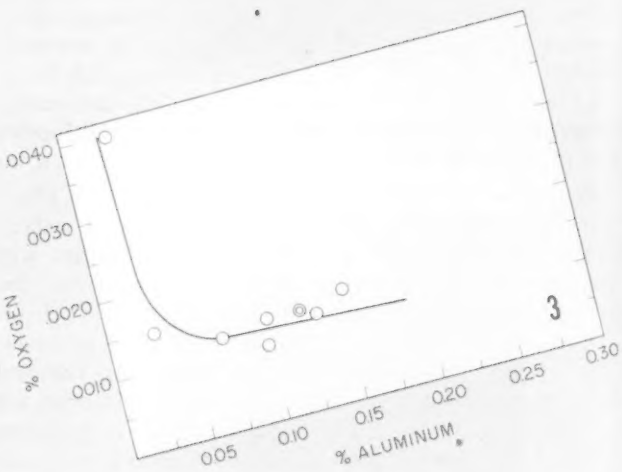


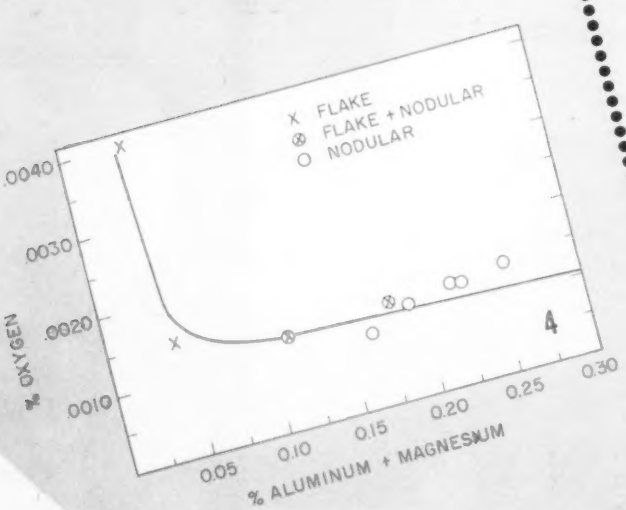
DEOXIDATION IN PRODUCTION OF Nodular

By GERHARD DERGE
Professor of Metallurgy
Carnegie Institute of Technology
Pittsburgh









1 Oxygen in iron vs residual magnesium

2 Residual magnesium vs residual aluminum

3 Oxygen in iron vs residual aluminum

4 Oxygen in iron vs residual magnesium plus aluminum, showing graphite structure

Cast Iron

THE great recent interest in nodular cast iron has led to extensive investigation of production methods. The commonest and most successful of these have involved the use of cerium[1] or magnesium[2, 3], but it has been demonstrated that nodules can also be obtained with such elements as lithium, sodium, calcium, barium or strontium[4]. This has led to speculation that nodule formation may be fundamentally related to deoxidation or desulphurization or both, but inadequate factual evidence has been provided in support of these ideas.

The experiments described here show that the magnesium treatment which results in nodule formation is also accompanied by deoxidation. It should be emphasized, however, that no claim is made to a complete unraveling of the problem, and the results are presented as contributory rather than final evidence.

To eliminate from the problem as many composition variables as possible, the melting stock for these experiments consisted of wash metal prepared in the laboratory by saturating Armco ingot iron with carbon. Analysis: C 3.5 per cent, Mn 0.012, P 0.018, S 0.025. Melting was done in a 15-lb induction furnace, and 50 per cent ferrosilicon was added to give an estimated 3 per cent Si in the final product. The metal was poured at 1370° C (2500° F) into a preheated transfer pot containing the magnesium alloy (analysis: Mg 7 per cent, Si 45, Al 2.17, Ca 1.5 balance Fe) and cast at once into dry sand molds.

Samples were sucked into a chill mold by the modified wedge[5] method (a) just before pouring and (b) after the magnesium treatment. These samples were analyzed for oxygen by vacuum fusion and for residual magnesium spectroscopically. Although not an intentional addition, residual aluminum was also determined. Pertinent data are listed in Table I and plotted in Figs. 1, 2, 3, 4.

Examination of Table I shows that the magnesium treatment has lowered the oxygen content of the metal and that this is associated with the residual magnesium in the iron, shown graphically in Fig. 1. This should not be interpreted as a magnesium deoxidation curve, for it is necessary to consider the combined influence of all deoxidizing elements[6]. Fig. 3 shows that the decrease in oxygen was also accompanied by an increase in residual aluminum, and Fig. 2 shows a good correlation between the residual magnesium and aluminum.

The possible influence of silicon on oxygen was also considered, but there appeared to be no significant effect under the conditions of these experiments. Thus, the combined residual magnesium and aluminum would appear to account for the oxygen control in this system, and these factors are plotted in Fig. 4. Here the microstructures of the graphite in the product are also indicated. At the high oxygen end of the curve with low residuals, only flake graphite is found. The low oxygen end of the curve with high residuals is characterized by nodular graphite structure, while mixed structures of nodular and flake graphite are found in the intermediate samples.

This leads to the conclusion that under these relatively simple and limited conditions, the treatment of cast iron which produces nodular graphite is also accompanied by deoxidation of the iron and by a definite residual alloy content of magnesium and aluminum. It must yet be determined whether nodular iron results directly from this low oxygen level without reference to the deoxidation procedure used, or from some indirect result of the deoxidation such as formation of magnesium sulfide nuclei.

Acknowledgment—Co-operation of the Electro Metallurgical Division Research Laboratories and the Dow Chemical Corp. were an important contribution to the theses described in this report. Supplementary experiments were conducted by Jack Shegog.

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4. A. L. DeSy, *Metal Progress*, page 356, September, 1950.
5. G. Derge, *Yearbook* AISI (1949), p. 368.
6. D. C. Hilty and W. Crafts, *Transactions*, AIME, 188 (1950), p. 425.

TABLE I—Analytical Data on Heats Treated with Magnesium Alloy

Sample		% O	% Mg	% Al	% Al + % Mg	% Si	Graphite Structure
1	Before	.0019					
	After	.00096	.071	.095	.166	2.79	Nodular
2	Before	.0019					
	After	.0015	.014	.029	.043	2.67	Flake
3	Before	.0019					
	After	.0012	.046	.068	.114	4.95	Flake + Nodular
7	Before	.0034					
	After	.0041	.010	.029	.039	3.11	Flake
8	Before	.0024					
	After	.0013	.12	.10	.22	3.10	Nodular
9	Before	.0018					
	After	.0014	.107	.15	.257	3.42	Nodular
10	Before	.0034					
	After	.0013	.108	.12	.228	3.76	Nodular
11	Before	.0038					
	After	.0012	.062	.13	.192	2.98	Nodular
12	Before	.0020					
	After	.0013	.061	.12	.181	3.09	Flake + Nodular

This article is based on two theses conducted as part of the requirements for the Bachelor of Science degree at the Carnegie Institute of Technology: "A Study of the Functions of Magnesium Added to Molten Cast Iron," by W. L. Horigan Jr. (Prof. Gerhard Derge, advisor), and "The Effect of Chill on Nodular Iron," by A. J. Schulte (Prof. Malcolm F. Hawkes, advisor)

ALUMINUM ALLOY Die

The die casting process is becoming increasingly prominent as a method for producing aluminum castings. Last year nearly one-third of all aluminum castings were die cast. In this first of two articles the author describes the basic principles involved in aluminum die casting and the types of alloys used

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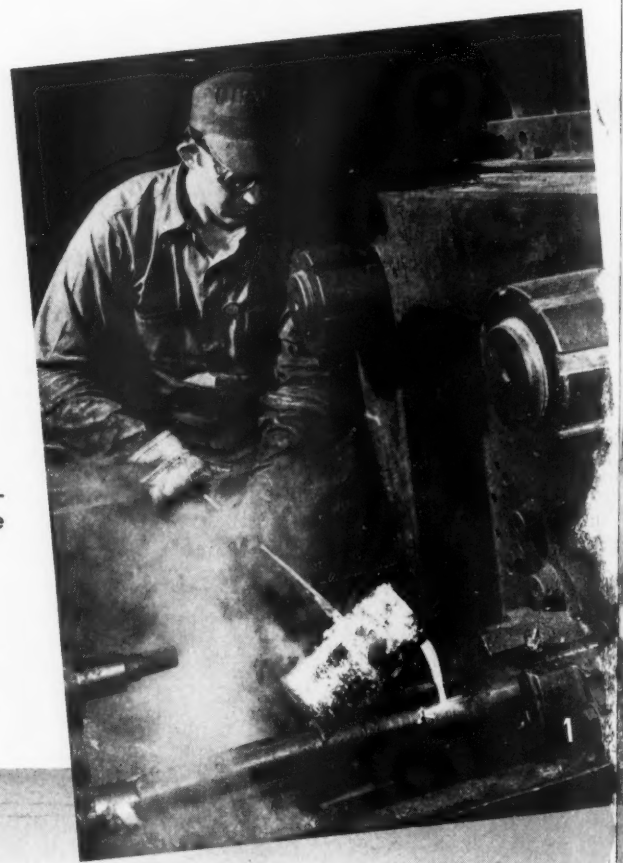
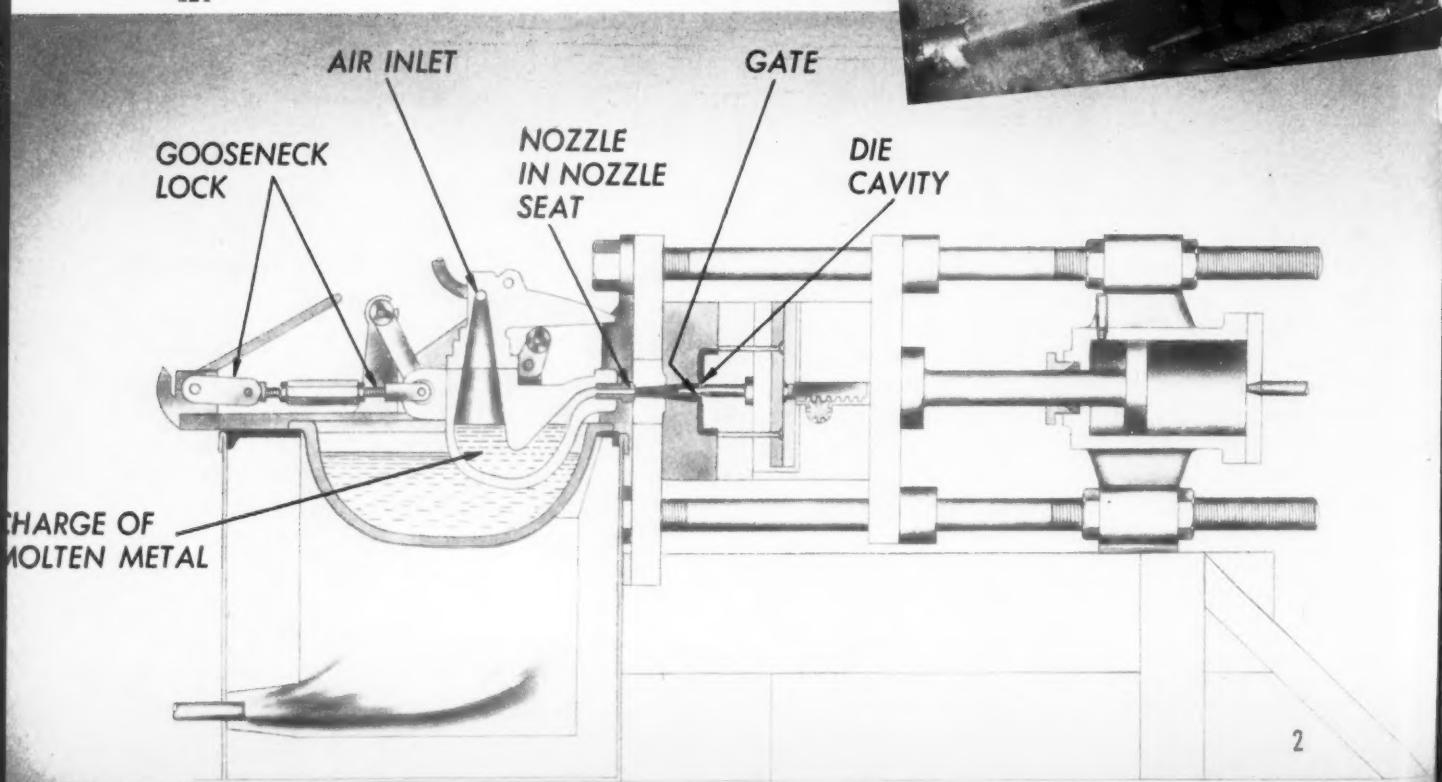


Fig. 1—Ladling metal into the injection cylinder of a cold chamber die casting machine

Fig. 2—Cross-sectional diagram of a gooseneck die casting machine ready for a "shot"



Castings

AN EXTREMELY rapid growth in the die-casting industry has paralleled the greatly increased use of the light metals, especially since World War II. More and more the die-casting process is being recognized as a low-cost mass-production method for the assembly of small and medium-sized parts.

Die castings offer possibilities for reducing costs, or improving product design, or both. Recent changes in die-casting practices and equipment have extended the usefulness of the process. Larger machines are now available which have extended the casting size limits beyond their former bounds. Faster small machines are being manufactured for the production of small die castings at higher rates. As a result, die castings that could not be produced economically a few years ago are now entirely feasible.

An increasing portion of the total die-casting production is being cast in aluminum alloys. In 1940, for example, aluminum die castings represented only 28 per cent of the dollar value of all die castings produced in the United States. During World War II, this percentage more than doubled, reaching a level of 60 per cent in 1944; but in 1946 it dropped to 31 per cent, or almost back to the prewar level. Since that time aluminum die castings have gained steadily until they now represent about 42 per cent of the total dollar value of all die castings.

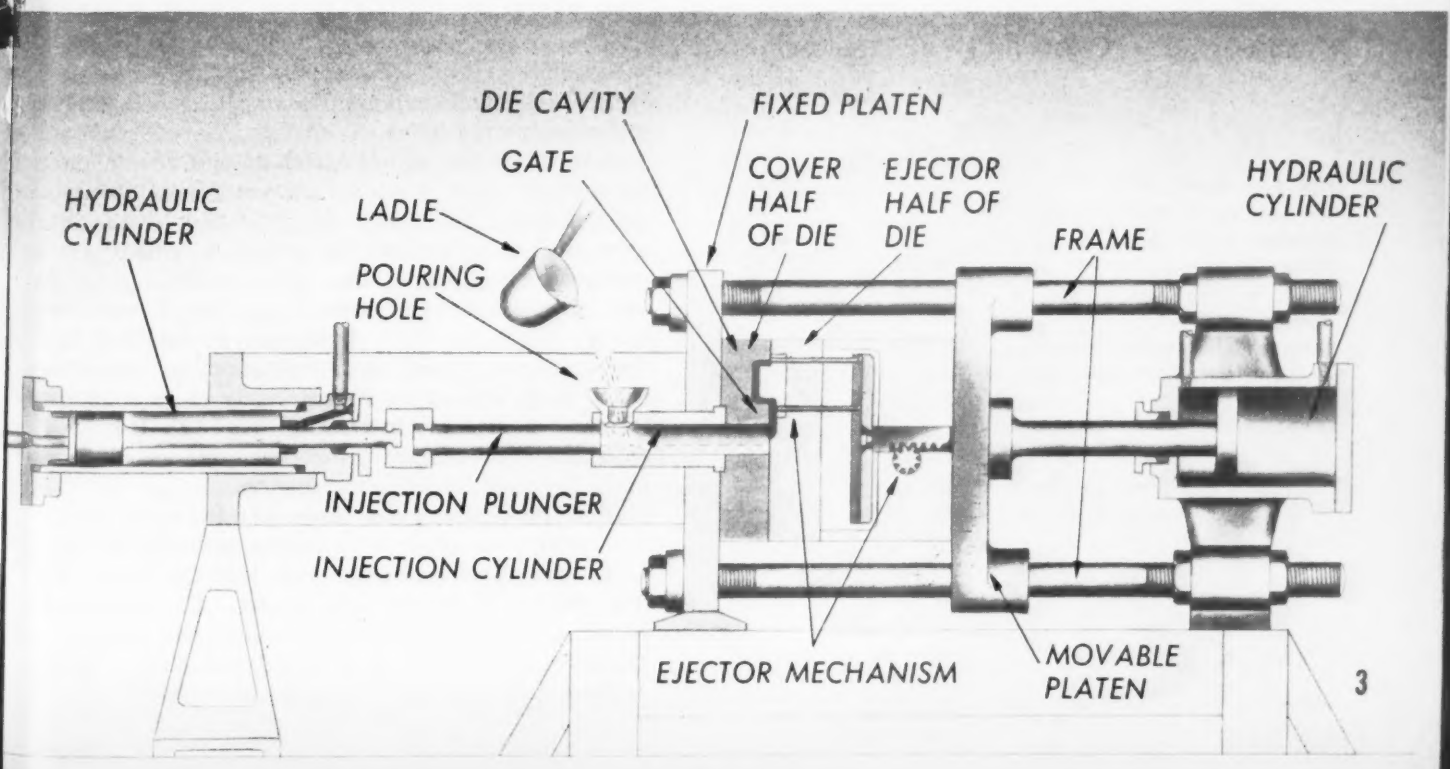
Statistics of the aluminum alloy casting industry also reveal the increasing importance of die castings. In 1942, about 17 per cent of all aluminum alloy castings produced were die castings. This increased to 19 per cent in 1946, to 27 per cent in 1948 and to 29 per cent in 1949. Last year die castings accounted for approximately 32 per cent of all aluminum alloy castings produced in the United States. This was slightly more than the 1950 percentage for permanent mold castings and compares with about 34 per cent for sand castings. Miscellaneous processes accounted for the balance.

As die casting is a mass-production process, it shows up to best advantage when large production runs of identical units are to be made. The smallest number of units for economical production varies with the nature of the part, however, and even as few as several hundred units is economical for die casting of some complicated parts.

In many instances, parts that require considerable machining when manufactured by other methods can be successfully produced by die casting with little or no machining. Where tooling for machining operations is expensive, or where assembling or surface finishing procedures account for a major part of the cost of a finished article, die casting may be used advantageously.

Perhaps the greatest advantage of the die-casting

Fig. 3—Cross-sectional diagram of a cold chamber die casting machine with principal parts indicated



process is its ability to reproduce complicated parts at low cost. Many structures that would otherwise have to be assembled from a number of separately fabricated parts can be produced at high rates as a single unit by the die-casting process.

An excellent example is the sound head of a well-known 16-millimeter motion picture projector (Fig. 5). This unit was previously manufactured as a 33-piece welded steel assembly. Redesign for production as a single aluminum die casting reduced fabricating operations from 45 to 21; eliminated three of the four original inspections; and cut cost 27 per cent. The new die-cast head also decreased the weight of the projector by about 3 pounds and gave it a neater appearance.

Smooth surfaces and close dimensional tolerances are important advantages of die castings. Fine surface detail can be faithfully reproduced by this process. As a result, no finishing beyond simple trimming is necessary for the majority of applications. Where machined surfaces are required, only light cuts are necessary, or even desirable, with die castings. Thin sections can be successfully cast by the die-casting process.

The principal limitation of the die-casting process is the maximum size of parts that can be produced within the limits of available die-casting machines and economical die construction. As already mentioned, these limits have been expanded somewhat in recent years. Aluminum die castings weighing from a fraction of an ounce up to 20 pounds can now be produced economically. Parts measuring up to 36 x 12 x 9 inches in overall dimensions are now being successfully die cast in aluminum alloys, and parts having maximum lengths up to 84 inches have been produced.

Because of the rapidity with which the metal cast in massive steel dies is chilled, die castings characteristically have an outer skin of dense fine-grained metal having high strength. The metal in the interior portions of the cast sections has exhibited greater gas porosity than similar sections in castings of other types. Porosity is greatly reduced, however, at the higher pressures possible with modern cold-chamber machines.

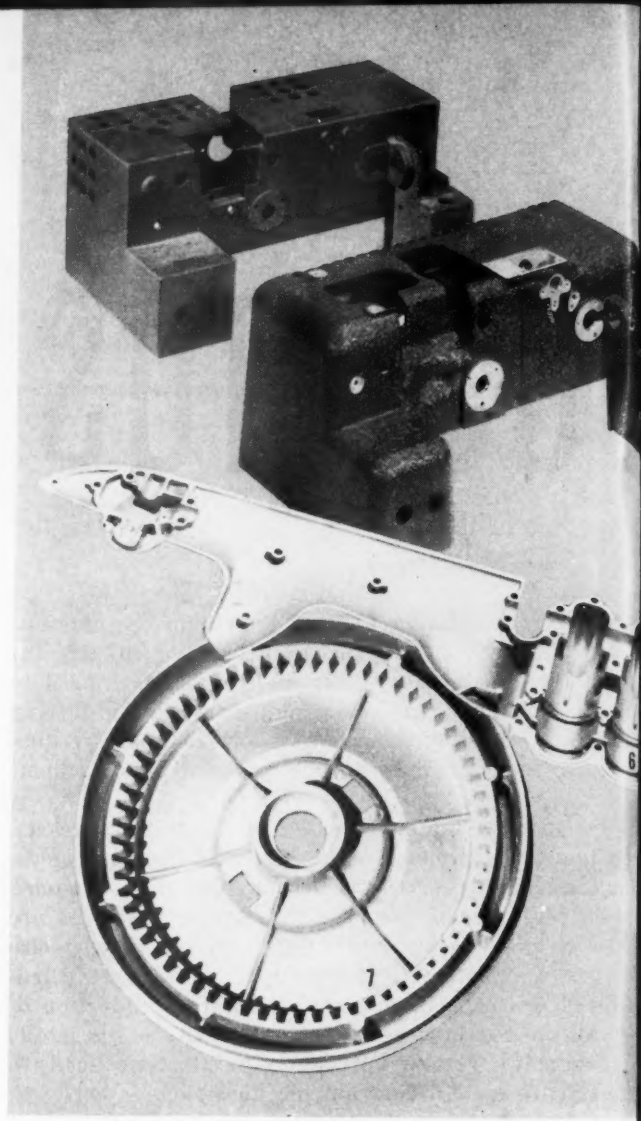


Fig. 5—Sound head of motion picture projector was die cast (foreground) at 27 per cent saving in cost compared with 33-piece welded assembly (background)

Fig. 6—One of two die castings for cylinder block, gear and drive shaft housing of an outboard motor

Fig. 7—Die cast lawnmower wheel (Al-Si-Cu alloy)

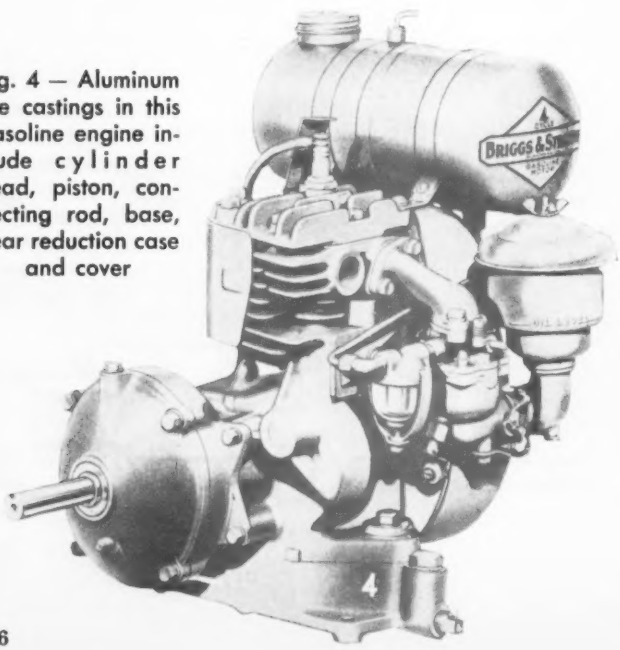


Fig. 4 — Aluminum die castings in this gasoline engine include cylinder head, piston, connecting rod, base, gear reduction case and cover

Heat treatment as ordinarily applied to aluminum castings of other types is not used with aluminum die castings. The rapid chill produced by the massive steel dies leaves the metal in essentially a quenched condition so that there is little room for improvement of mechanical properties by separate heat treatment. Heat treatment at relatively low temperatures is used to a limited extent for stress relief when machining to extremely close tolerances is required, and for increasing ductility. Proper design and alloy selection, however, will usually eliminate the need for such treatments.

How Die Castings Are Made—As the name implies, die castings are produced by introducing molten metal into a die which contains a cavity of the correct size and shape to form the desired part. The die is made in two parts so that it can be opened and the casting removed after the molten metal solidifies. The die is then reclosed and the process is repeated.

Fig. 8—Typical aluminum alloy die castings

What the name does not imply is that the molten metal is forced into the die cavity under pressure. The method of applying this pressure distinguishes the two principal types of die-casting machines in use today for aluminum alloys—air-injection (gooseneck) and cold-chamber or high-pressure machines. In the former, pressures up to about 750 psi are used. In cold chamber machines pressures of 3000 to more than 20,000 psi are applied.

The two general types of aluminum die castings are identified in the same manner as the machines that produce them. When die castings of aluminum were first produced, about 1914, the same machines that had been in use for zinc and other metals were considered. In these machines a metal plunger, which was in contact with the molten metal at all times, forced the metal from a reservoir forming part of the machine through a nozzle shaped somewhat like a gooseneck (hence the name) into the die.

The higher temperature of the molten aluminum plus the tendency of the metal to pick up iron from the metal injection cylinder made this method impractical for aluminum alloys. To overcome these difficulties, air-injection was applied to the gooseneck to force the molten metal into the die. This method is still in use for alumi- (*Please turn to page* 271)

TABLE I—Nominal Composition of Aluminum Die Casting Alloys

Designation			Per Cent Alloying Elements (Balance Aluminum)		
ASTM	Alcoa	SAE	Copper	Silicon	Magnesium
G2	218	...	..	...	8.0
S4	43	304	..	5.0	..
S5	13	305	..	12.0	..
S9*	...	...	..	12.0	..
SC2	85	307	3.5	5.0	..
SC5*	...	...	3.5	5.0	..
SC6*	A380	306	3.5	8.5	..
SC7	380	308	3.5	8.5	..
SG2*	A360	...	..	9.5	0.5
SG3	360	...	..	9.5	0.5

* Impurities in these alloys, particularly iron, are more closely controlled than in the other alloys of otherwise identical composition. These alloys can be cast only in cold-chamber machines.

TABLE II—Typical Mechanical Properties of Aluminum Die Casting Alloys

Alloy	Tension Tests on Round Specimens			*Charpy Impact on Square Specimens, ft-lb
	Yield Strength, psi	*Ultimate Strength, psi	*Elongation in 2 in., %	
G2	27,000	41,000	7.5	8.3
S4	16,000	30,000	5.0	4.5
S5	21,000	37,000	1.8	2.0
S9	18,000	35,000	3.5	..
SC2 ...	24,000	38,000	2.5	2.5
SC5 ...	20,000	35,000	3.0	3.0
SC6 ...	25,000	41,000	3.0	3.5
SC7 ...	26,000	43,000	2.0	3.2
SG2 ...	23,000	43,000	5.0	4.2
SG3 ...	27,000	43,000	3.0	2.7

* From "Tentative Specifications for Aluminum-Base Alloy Die Castings," B85-48T, ASTM, 1948.

Design features of the open-hearth furnace and its method of operation are discussed in this second of a series of articles covering melting practice in the steel foundry

STEELMAKING FOR

THE open-hearth process owes its name to the fact that the steel is made in a large shallow bath, open to inspection through doors in the furnace structure, in contrast to the bessemer converter, whose contents can not be seen at any stage of the process. The open-hearth furnace might well have been called the regenerative furnace, as it was the first successful use in metallurgy of the regenerative principle of firing.

There are two methods by which the working chamber of a furnace can be raised to a temperature much above the melting point of pure iron or low carbon steel, and maintained at that temperature as long as desired. One is electric arc or resistance heating, the other what is known as the regenerative method of burning liquid or gaseous fuel. Regenerative firing, invented and developed about a century ago by Siemens in England and by Martin in France, is used in many types of furnaces operated at high temperature, including the open-hearth steel melting furnace. Before this method was developed, there was no known way of maintaining soft steel or iron in the molten state.

The basic principle of regenerative firing is that the air required for combustion of the fuel, and sometimes the fuel itself, are highly heated before being fed into the furnace hearth where the fuel is burned and the metal or other material melted. As a result, the temperature of the flame is much higher than it would be, were cool air used. The combustion air is preheated by sensible heat extracted from the hot products of combustion of the fuel.

By means of suitable valves the cool combustion air is made to pass through one of two chambers

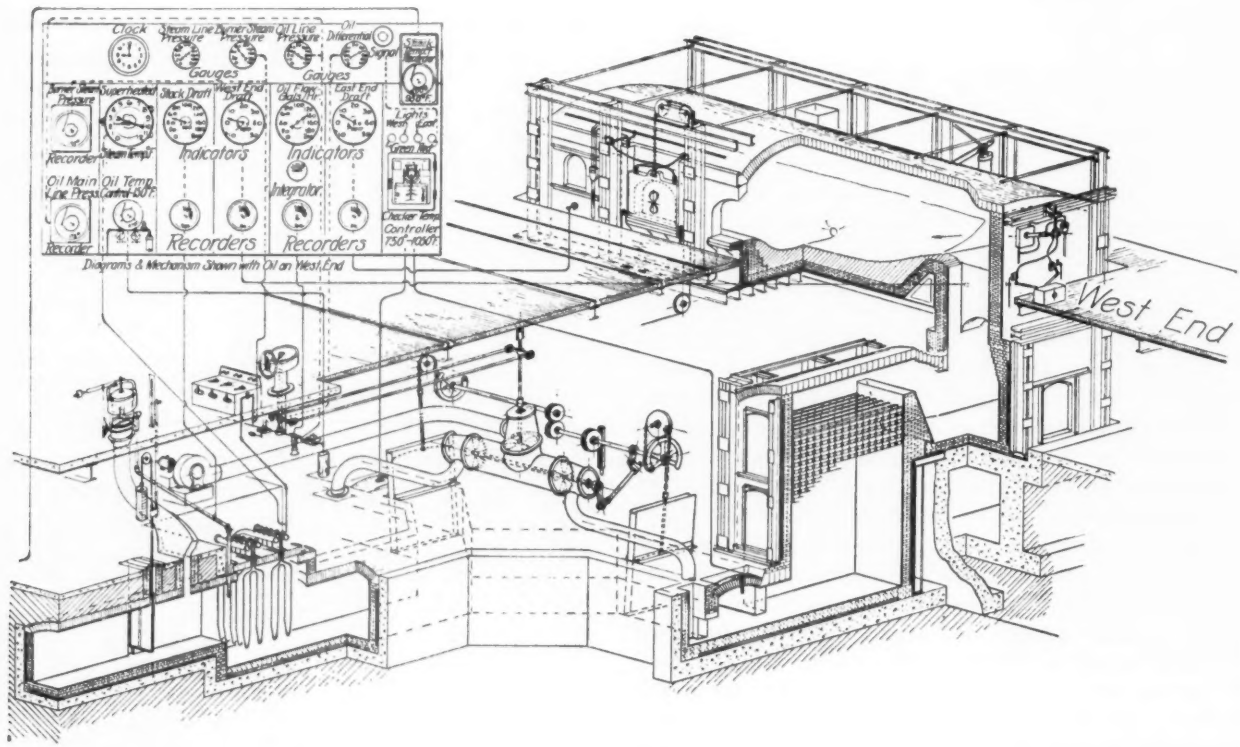


Fig. 1—Isometric sketch showing general arrangement of a basic open-hearth furnace according to J. W. Porter

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R CASTINGS

filled with checker-works of firebrick, located at opposite ends of the furnace body. From the checker chamber the air flows into the space above the furnace hearth, where it meets the fuel, and where combustion takes place. As they leave the hearth, the hot products of combustion pass out through the second checker chamber, and give up a large part of their sensible heat to it before being evacuated to the stack. Every 15 or 20 minutes, the direction of flow is reversed, the cool air then entering through the checker chamber that was being heated during the previous cycle, and the hot products of combustion passing out through the one at the other end of the furnace.

When the hearth is being brought up to temperature, the direction of the flow of air and hot gases is reversed each time before the checker work that is giving up its heat has cooled to the temperature it possessed at the beginning of the previous heating cycle. Thus at each reversal, the temperature of the checkers, and hence, that of the flame in the furnace, is stepped up, until full working temperature is attained. When in operation, the cooling effect of the metal being melted and radiation losses from the roof and walls keep the furnace from becoming hot enough to melt down. The temperature of the checker chambers then fluctuates regularly between a definite maximum and minimum.

The hearth of a regenerative-fired open-hearth furnace may be lined entirely with silica (SiO_2), an "acid" material, and the slag which covers the steel then contains a high proportion of silica. Such a slag, as will be explained further on, cannot retain phosphorus in solution; (*Please turn to page* 263)

TABLE I—Open Hearth Refractories

Product	Raw Material
Fire clay brick	Clay, chiefly kaolinite, Al_2O_3. 2 SiO_2. 2 H_2O
Silica brick	Quartzite, chiefly SiO_2
Dead-burned magnesite brick	Magnesite, $MgCO_3$
Dead-burned grain magnesite	Magnesite, $MgCO_3$
Chrome Brick	Chromite, FeO. MgO. Al_2O_3. Cr_2O_3. Fe_2O_3
Ground chrome ore	Chromite, as above
Chrome-magnesite brick	Chromite plus dead burned magnesite.
Chrome-magnesite grain mixtures	Chromite plus dead burned magnesite.
Calcined dolomite	Dolomite, $CaCO_3$. $MgCO_3$
Silica Sand	Silica sand, or weakly bonded silica sandstone.

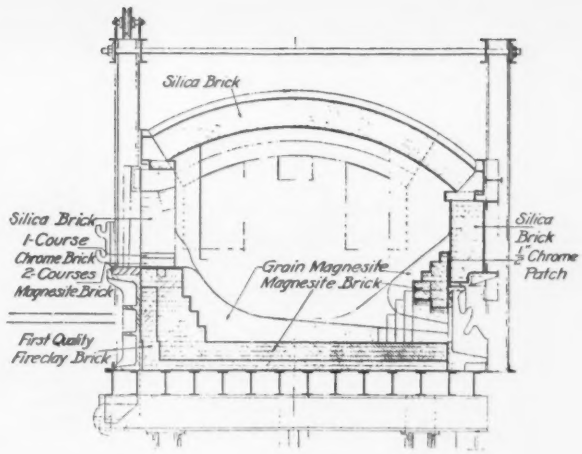

Fig. 2—Cross-sectional view of furnace on a center line through the taphole

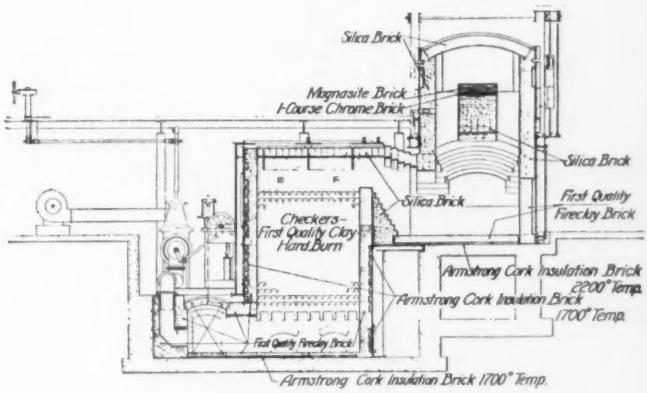

Fig. 3—Another view of the furnace with cross section taken at the downtakes

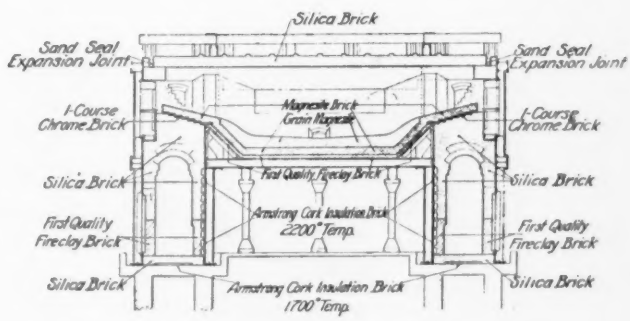

Fig. 4—Sectioning along center line through the length of the furnace

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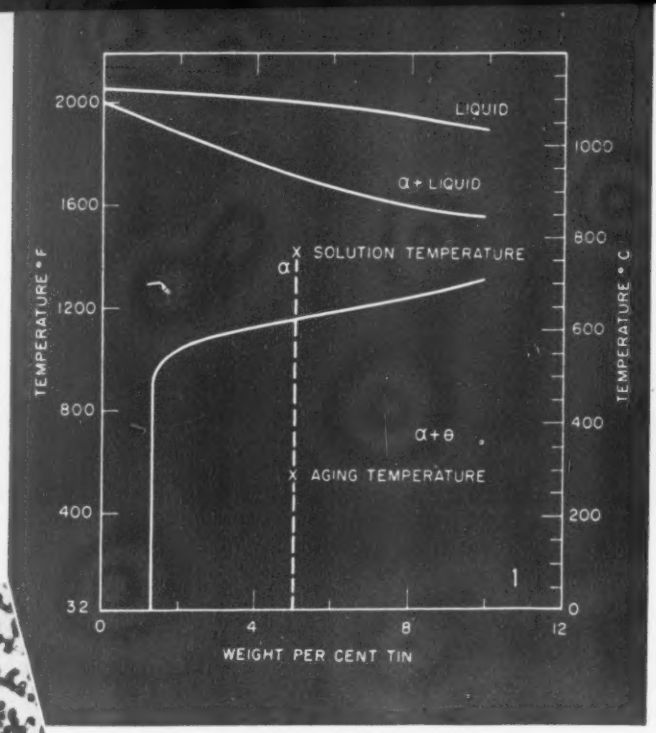


Fig. 1 — Section through nickel-tin-copper diagram of 5 per cent nickel alloy

Fig. 2—Typical as-cast structure of 5% Ni, 5% Sn alloy. X75, ammonia-peroxide deep etch

Fig. 3 — As-cast structure. Occasional patches of "acicular theta" occur in higher alloy (8% Ni, 8% Sn) structure. X500, ammonia-peroxide light etch

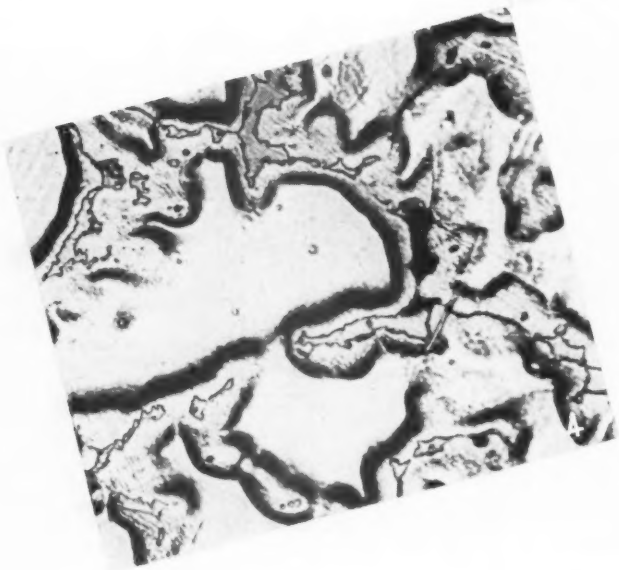


Fig. 4—Same as Fig. 2. X500, ammonia-peroxide deep etch. Particles of theta phase in grain boundaries

Fig. 5 — Typical as-cast structure in 5% Ni, 5% Sn bronze, showing theta particles along grain boundaries. X500, ammonia-peroxide light etch

Continuing his description of the nickel-tin bronzes, the author supplements his report presented in the February issue with a discussion of the theory governing the constitution and heat treatment of these alloys

Nickel-Tin Bronze Theory

THIS discussion is a supplement to an earlier description (FOUNDRY, February, 1951, page 102), dealing with the metallurgy and properties of nickel-tin bronzes. It draws mainly upon the work done by Kihlgren[1], Eash and Upthegrove[2], and Eash and Wise[3], and the references they quote, amongst which the work of Price, Grant and Phillips[4] deserves special mention.

A bronze which possesses a tensile strength of 50,000 psi as cast and delivers 90,000 psi when heat-treated, owes the foundryman a description of how this achievement is brought about. Commercially, these alloys have been trade named Ni-Vee[5] bronze. The Ni-Vee bronzes are copper-base alloys containing essentially 5 per cent nickel and 5 per cent tin with varying amounts of the other ingredients common to brasses and bronzes.

Briefly, the effect of nickel in these bronzes is based upon the point that nickel and tin form a constituent which is completely soluble in the liquid metal but possesses a limited solubility in the solidified metal. A small portion of the nickel tin component precipitates during solidification (Fig. 4), and by doing so, strengthens and hardens the casting. Most of the nickel-tin remains in solution, and needs to be forced to precipitate by a heat treatment that provides a favorable period of heating at a specific temperature. The precipitation is dormant at temperatures below 400°F. It becomes active above 500°F, and at 550°F provides a very fine microscopically invisible precipitate. Precipitation is more rapid at higher temperatures up to 900°F.

At temperatures above 1200°F, re-solution of the nickel-tin constituent takes place and the product, if quenched, is restored to its soft ductile condition. The diagrams charting these effects have been comprehensively worked out by Eash and Upthegrove,[2] and Eash and Wise.[3] The presence of lead in Ni-Vee bronzes makes the heating of them above 600°F undesirable for many casting applications because the melting temperature of the lead component is approached or exceeded at this temperature and the normally solid particles of lead would be expected to fuse and flow. Since lead does not participate importantly in the constitutional changes which bring about the strengthening and hardening effects in the Ni-Vee alloys, its presence will be disregarded in the following discussion of the principles underlying the heat treatment.

Fig. 1 pictures the phase relationships existing for the 5 per cent nickel alloy. The curved line in the southwest quadrant of the chart marks the limits of tin solubility in the product. The solubility of tin in the alpha phase is rapidly reduced at temperatures below 1300° F to a level of less than 2 per cent tin at temperatures of 1000° F and below. The response to heat treatment then depends upon the proportions of nickel and tin available in the alloy, their distribution upon solidification or quenching, and their precipitation upon heating in the range of 500 to 900° F.

Just as carbon progressively strengthens iron from the "soft steel" to "machine steel" to "drill steel" condition, so too do increasing quantities of nickel-tin in a copper base, progressively form (a) a soft, tough bronze; (b) a strong, medium hard bronze; and (c) a high-strength, hard bronze. As carbon in amounts increasing up to 0.80 per cent contributes strength to steel by the formation of an iron carbide through a compound called pearlite, so too do nickel and tin in equal amounts, above 2 per cent of each and up to 8 per cent of each, form a compound contributing to the strengthening and hardening of a copper-base composition (see Figs. 2 and 5). As in steel, all constituents are completely soluble in the liquid phase.

There are basic differences in the mechanism of solution and precipitation of carbon in steels as compared to nickel-tin in copper-base alloys; to simplify the comparison, the difference will be ignored. There apparently is no change in crystal form in Ni-Vee bronze upon cooling, such as there is in steel. There is only the fact that the nickel and tin in excess of 2 per cent of each, are endeavoring to assemble to form a nickel-tin compound and precipitate. They re-

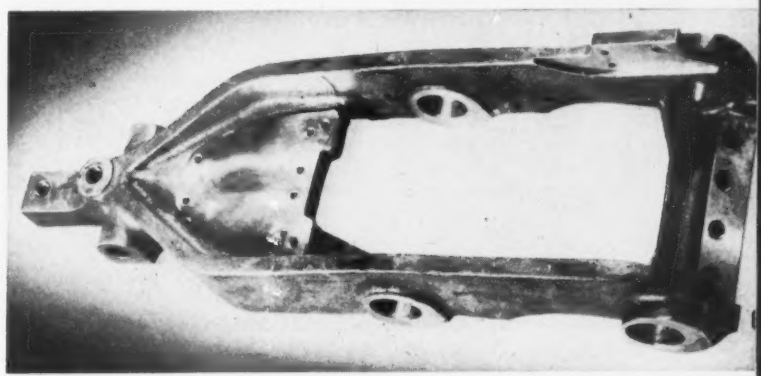


Fig. 6—Typical application of heat treated nickel-tin bronze casting for a circuit breaker

main soluble at temperatures above 1400° F in the range of the marks alpha and X shown in Fig. 1. At about 1300° F and down to 1150° F, the nickel-tin compound begins to form.

In the course of an extremely slow cooling approaching "equilibrium rates" of the order of 20 hours or more through the 1200° F to 600° F temperature range, the nickel-tin alloyed theta phase would emerge and the tin content remaining in solution would be reduced to 2 per cent tin. The final product would have precipitated its full quota of the nickel-tin constituent. But in ordinary foundry practice, the infinitely slow cooling necessary for equilibrium does not occur. Instead, the casting cools quite rapidly from the 1200° F temperature range, through the 1000° F alpha-theta-alpha boundary, leaving appreciable quantities of the tin-nickel constituent in solid solution. It will now have a tensile strength of about 50,000 psi and a hardness of 80 bhn.

Nickel-tin bronzes that are tempered or reheated after casting, behave in a manner resembling that of an air-hardening alloy steel. Tempering would be helpful in developing maximum strength or hardness.

The solid solution of nickel and tin in copper in this case is regarded as supersaturated and, under favorable conditions (such as heating for 4 hours or more at 550° F), as marked by point X = aging temperature in Fig. 1, can be made to precipitate some more of the nickel-tin compound. As mentioned above, in the case of extremely slow cooling, the final product would have arrived at its fully precipitated condition with a strength of about 65,000 psi and a hardness of 130 bhn. It would have been assisted toward this goal by the 550° F reheating.

As in the case of steels, remarkable improvements in strength and hardness can be achieved by quenching and tempering heat treatments. In principle,

Fig. 7—Ultimate strengths of cast nickel-bronze alloys annealed 10 hr at 1400°F, water quenched and aged 5 hr at 600°F

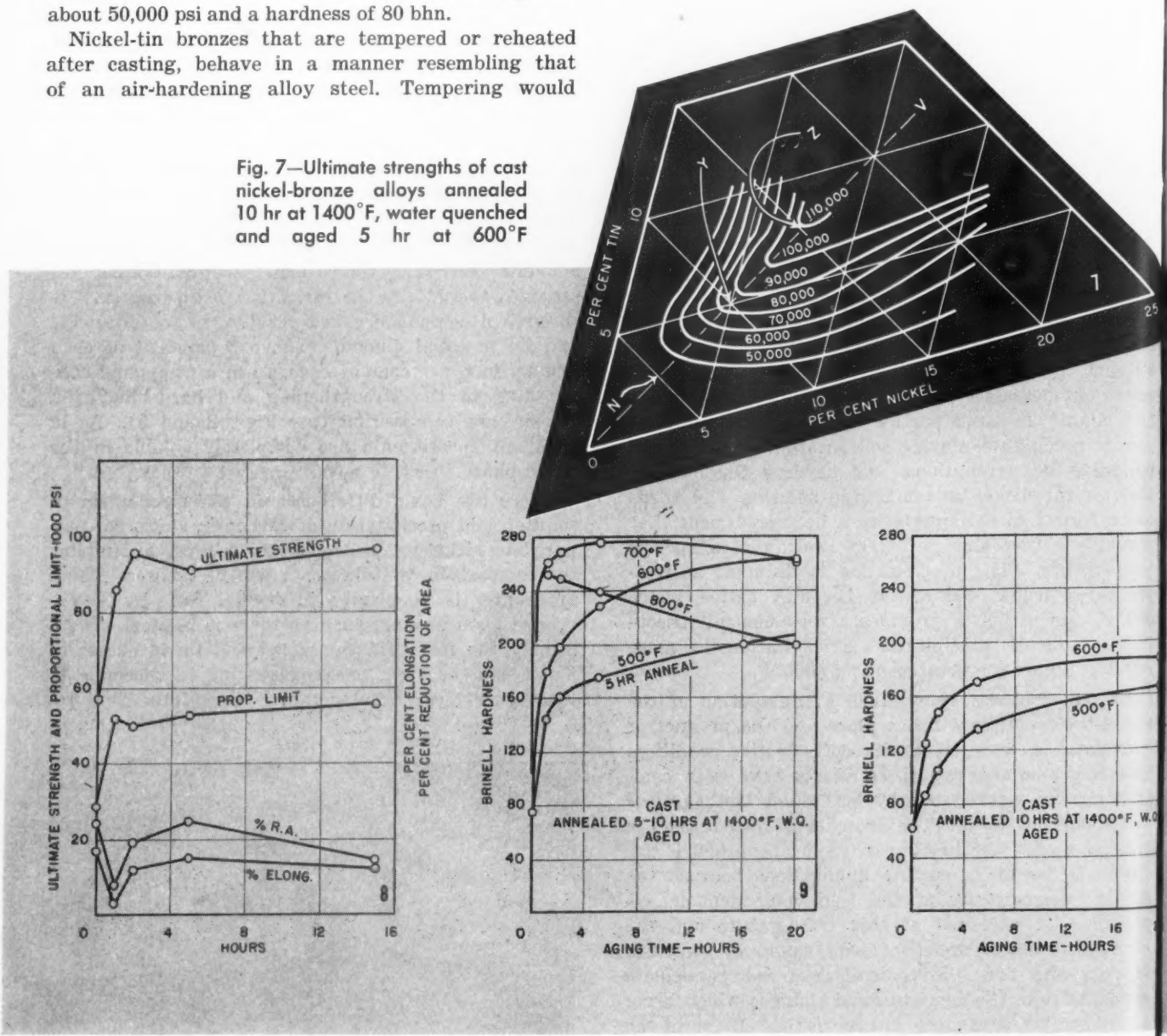


Fig. 8—Effect of annealing time, prior to quenching, on tensile properties of sand cast 7½% Ni, 8% Sn alloy, subsequently quenched and heated 5 hr at 500°F. Fig. 9—Effect of time and temperature on brinell hardness of quenched alloy containing 7½% Ni and 8% Sn. Fig. 10—Effect of time and temperature on brinell hardness of quenched alloy containing 5% Ni and 5% Sn

these heat treatments for steel and nickel-tin bronze are similar. During solidification and normal cooling of a Ni-Vee bronze casting, a small amount of nickel-tin compound is precipitated in a somewhat coarsened form. (See Figs. 2 and 4). Heating to 1400° F is desirable to redissolve the precipitate. Quenching in oil or water fixes the dissolved state of the constituent in the structure. Tempering at about 600° F permits control over the rate of nucleation and precipitation. Heating for as short as 2 hours at 1400° F followed by rapid cooling or quenching and tempering produces excellent mechanical properties (Fig. 8).

A longer heating at 1400° F of the 5 per cent nickel, 5 per cent tin bronze shows that the 550° F tempering heat treatment after quenching produces an excellent combination of high strength and good ductility (Table I). Higher yield strengths and proportional limits can be obtained with higher tempering temperatures, but at the expense of decreased ductility. Maximum hardening and strengthening effects are produced by providing a 6 to 10 hour solution treatment at 1400° F within which the nickel-tin precipitate dissolves and diffuses, then quenching, and finally tempering for 6 to 10 hours at about 600° F for best results.

The comment previously made, concerning the ill effects of lead upon nickel-tin bronze might bear repeating here with the (*Please turn to page* 278)

TABLE I—Mechanical Properties of Nickel Bronze Alloys As Cast and Heat Treated

Composition* per cent		Heat Treatment: Annealing (Water Quenched)		Heat Treatment: Aging (Quenched)		Ultimate Strength, psi	Proportional Limit, psi	Yield Strength (0.2% permanent set) psi	Elongation, % in 2"	Reduction of Area %	Brinell Hardness No.
Ni	Sn	° F	hr	° F	hr						
..	..			No Heat Treatment		25,900	4,000	9,000	57	68	43
5	5			No Heat Treatment		48,850	13,500	22,800	44	50	75
		1400	10	500	5	74,000	40,000	53,000	27.5	29	136
		1400	10	600	5	84,000	47,500	66,000	16	26	171
7.5	5.5			No Heat Treatment		56,500	24,000	29,400	36	34	...
		1400	5	500	10	86,300	50,000	64,500	22.5	34	165
		1400	5	650	5	103,900	62,000	.....	5	8	213
7.5	8			No Heat Treatment		58,000	25,000	34,000	18	18	105
		1400	5	500	5	89,650	55,000	76,000	18	34	179
		1400	10	600	5	111,150	66,000	.....	6	7	228

* All alloys listed above contain 2 per cent zinc

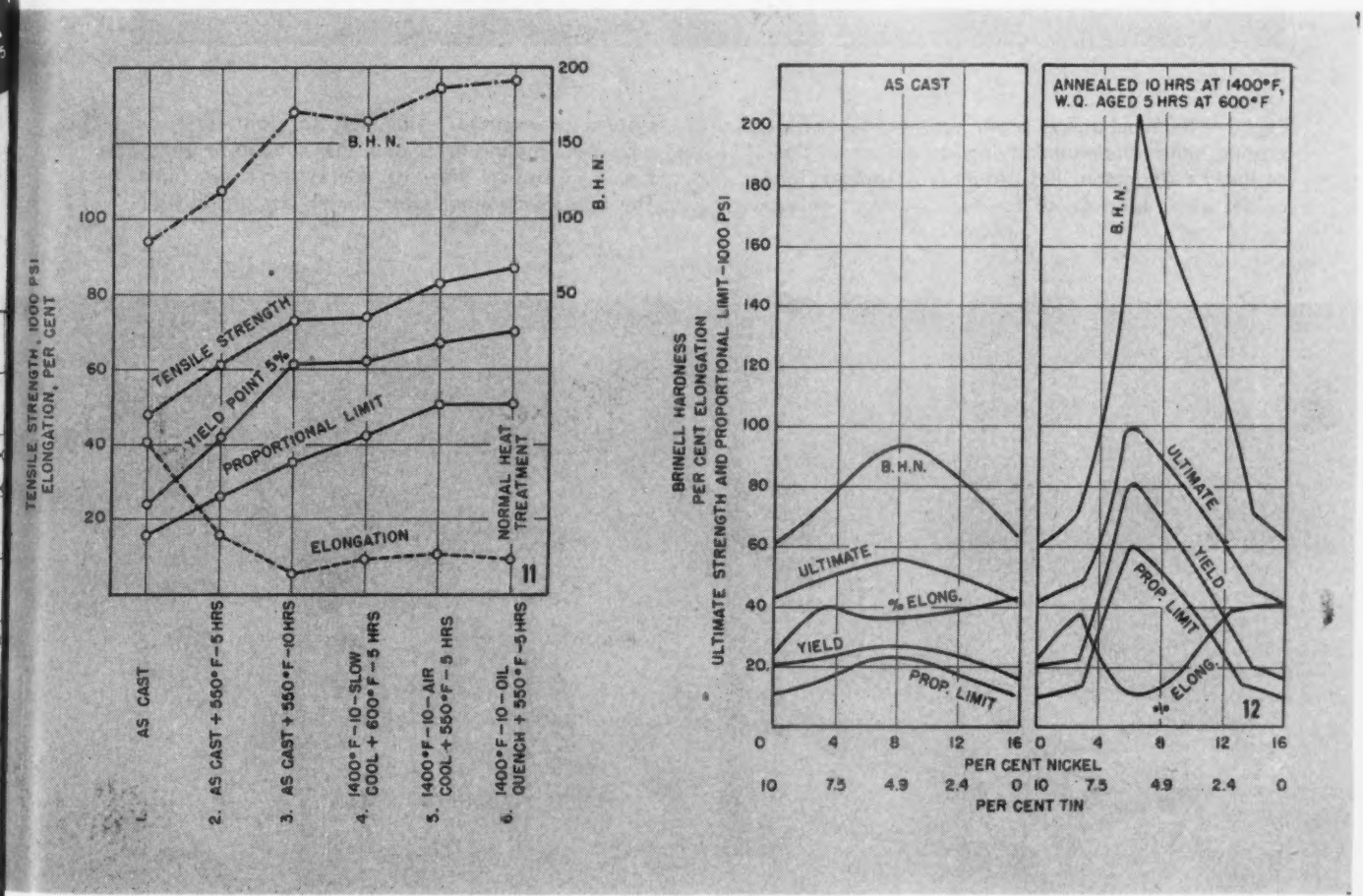
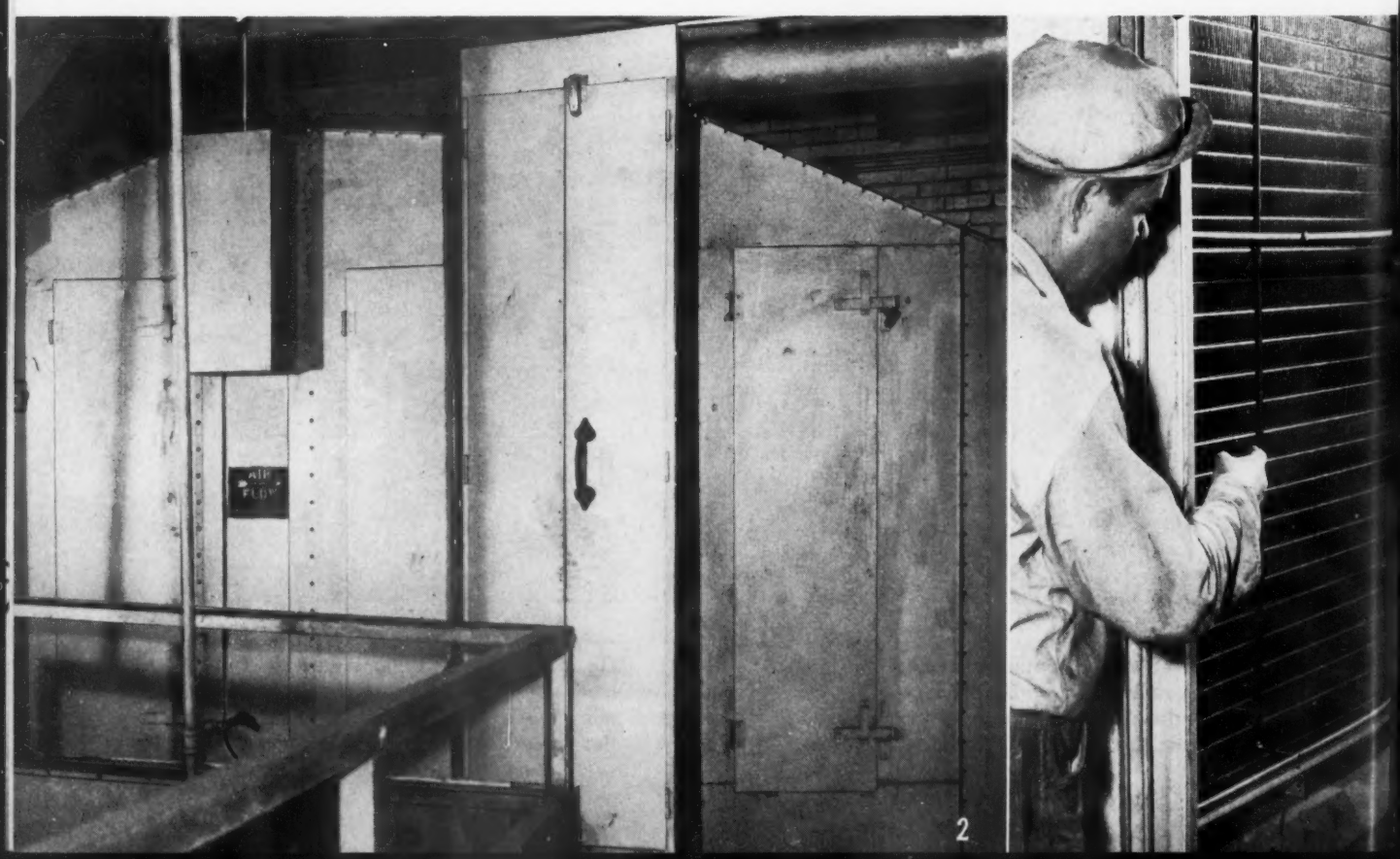


Fig. 11—Showing tensile and hardness values that are produced for corresponding heat treatments applied to nickel-tin bronze

Fig. 12—Nickel and tin in complementary proportions indicate maximum tensile and hardness properties occur at 6 to 8% of each

Fig. 1—This mechanical brain controls the refrigerating units for dehumidifying cupola air at Delco-Remy's Anderson, Ind., foundry. Temperature of the air is held at 40°F. Fig. 2—Heart of the system. Its various units, left to right, are the air filter, cooling coils and the condenser room. Fig. 3—Close-up view of the system's air filter. The filter is cleaned automatically by an oil bath



By WILLIAM K. MITCHELL
Delco-Remy Division
General Motors Corp.
Anderson, Ind.

Refrigeration

L BLAST MOISTURE

FOR SOME TIME gray iron castings poured by Delco-Remy Division of General Motors Corp. at its Anderson, Ind., foundry had been susceptible to flaws caused by gas in the molten metal, because almost all of the castings are poured in permanent molds.

Venting gas naturally is more difficult from permanent molds than from sand molds. Trapped, and unable to escape through the solid mold, any hydrogen gas present in the metal can cause surface porosity in the casting. It was believed that the hydrogen gas was being introduced into the metal by the breakdown of moisture in the cupola blast air.

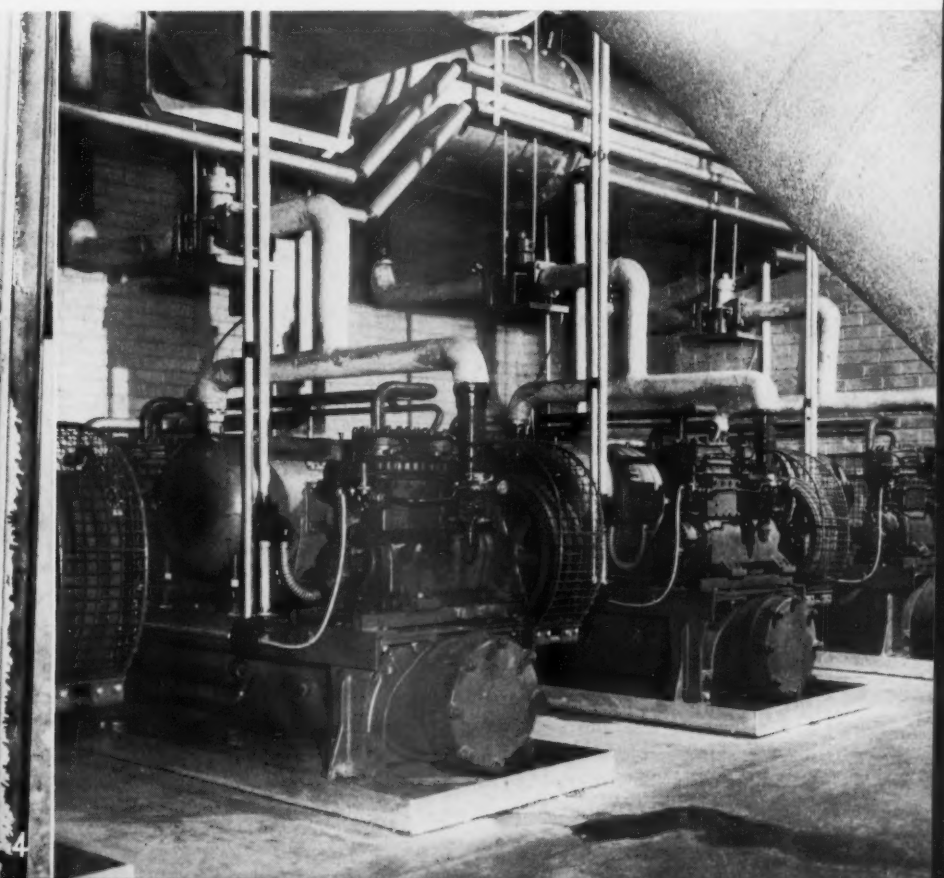
A study of scrap in this foundry, during 1949, showed that the scrap loss closely followed the amount of humidity in the atmosphere. During the summer of 1949, for instance, the scrap loss averaged around 15 per cent and, at the same time, the humidity reached as high as 10 grains per cubic foot of air (a relative humidity of 80 per cent at 85° F).

To combat this problem the foundry superintendent and engineers designed and installed a method of dehumidifying the air being fed into the cupola. Engineers from the Frigidaire Division of General Motors were called in to assist.

The result is a huge refrigeration system which provides absolute control over the moisture content of the cupola blast air. It cools the blast air to a constant temperature of 40° F. This temperature was chosen because air at a temperature of 40° F cannot

Fig. 4—Refrigerator coils are controlled by these solenoid valves. They are located for easy accessibility for adjustment or repair.

Fig. 5—The four refrigeration units have a total capacity of 80 tons. Air duct, discharging dehumidified air to the cupola, is at top



hold more than three grains of moisture per cubic foot, which is not enough to affect the castings adversely.

Figures for June, July and August, 1950, with the dehumidifier in operation, showed a startling improvement over the same period in 1949. Scrap loss dropped to an average of around 7 per cent, compared with 15 per cent in 1949. During this period, the atmospheric humidity was practically the same as for those months in 1949. On an average humid summer day the new dehumidifier removes as much as 9 lb of water per minute from the cupola intake air.

Average summer operating costs of the dehumidifying equipment are only about 70 cents per hour. The equipment does not operate in winter except when the outside temperature goes above 40° F.

The system consists of a sheet metal shell through which the cupola air is drawn. Inside the shell the air passes through an automatically cleaned filter and into the cooling chamber. Here, the refrigerating coils cool it to the required 40° F. Next the air is taken through a condensing room where the moisture falls to the floor and is drained out. The dried, filtered air then is forced through the duct into the cupola. The entire movement of air is accomplished by the cupola blower.

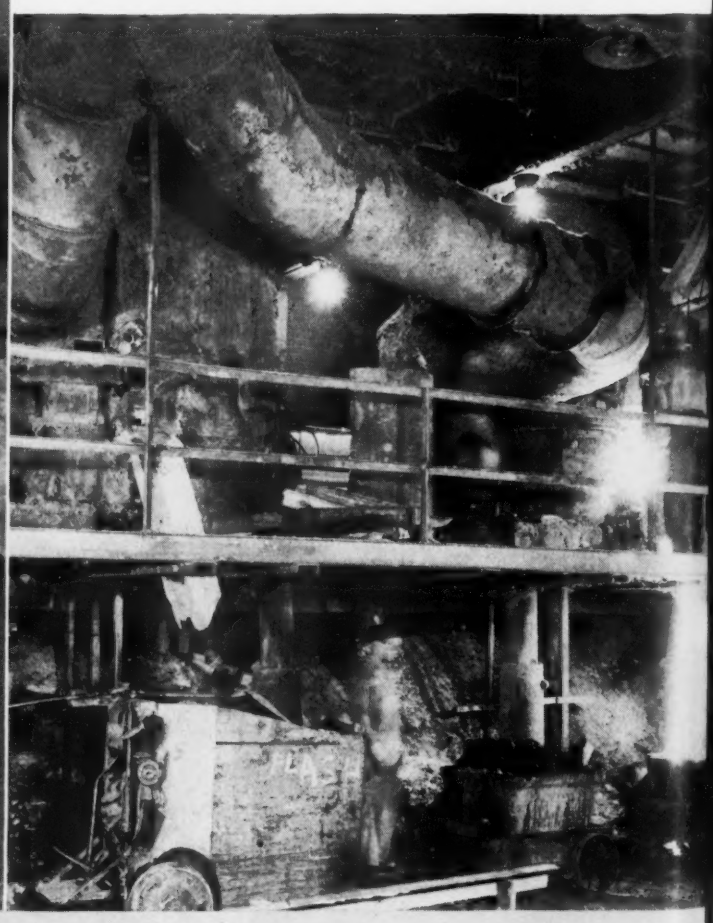


Fig. 6—Front slagging arrangement on cupola skims off slag through notch. Slag falls into stream of cold water and is carried away automatically by conveyor. Flame heater just over notch keeps slag flowing freely. Fig. 7—Former rear-slagging practice had slag dropping into trucks to be wheeled away. This arrangement contributed to excessive heat and fumes

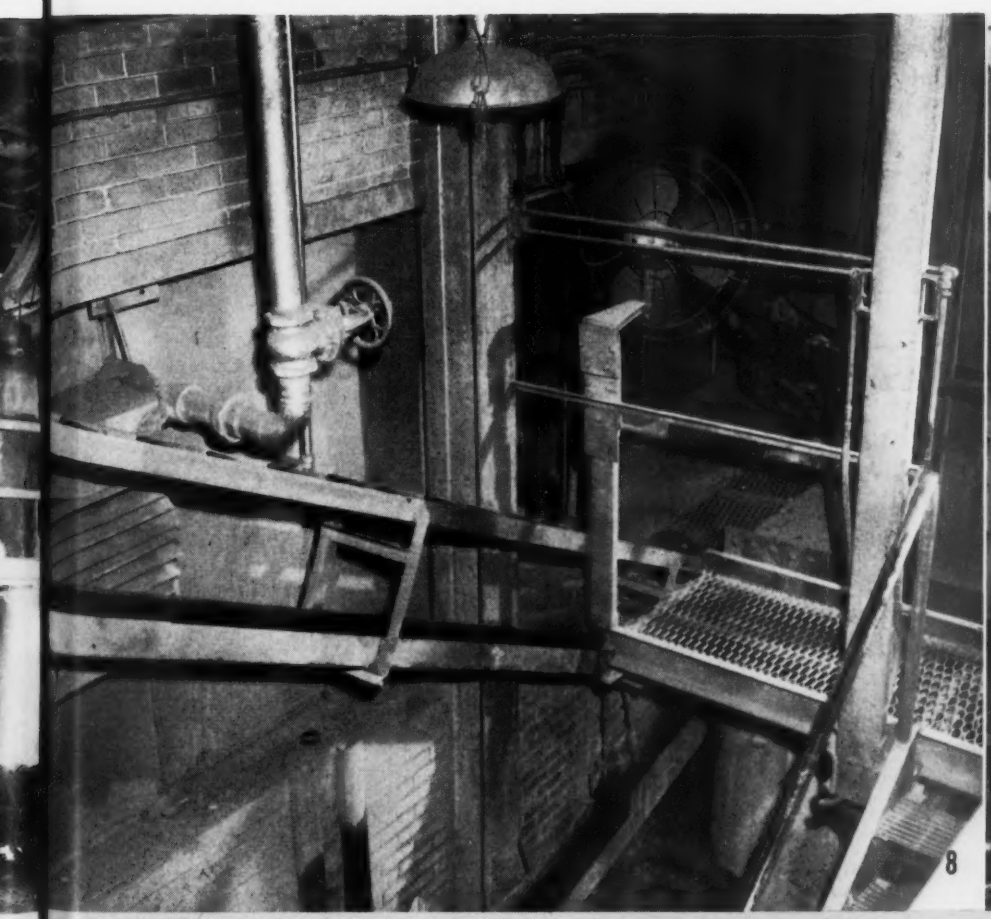
The refrigerator compressors—four standard Frigidaire units with a total capacity of 80 tons—are located in a special room. They are regulated automatically by a control unit, which can be set to maintain any given temperature. The compressor room is dustproof and ventilated with filtered air, thus protecting the compressor motors.

When in operation, the unit dehumidifies 6500 cu ft of air per minute. It is completely automatic, and both maintenance and operating costs are extremely low. Adding to the economy of the setup is the fact that the water from the refrigerating coils is pumped to the dust-suppressor sprays atop the cupola stacks and then is used a third time in the automatic slag removal system.

Slag removal in the Delco-Remy foundry had been a dirty and laborious process. It was done by hand, from the rear of the cupolas. A man had to be in constant attendance, maintaining the flow of slag through the slag door, with a bar. The slag dropped into trucks below where the slag man was kept busy guiding the trucks out to the slag pile. In addition, the cupola room was littered with rock wool, and fumes, heat and dust from the hot slag made undesirable working conditions in the space behind the cupola.

Delco-Remy's solution to this problem was to convert to front slagging. Fire-brick-lined troughs, leading from the front of each cupola into the holding furnace, were installed. A baffle-dam was placed in each trough, forcing the molten iron to go under it, before reaching the holding furnace. Since the slag floats on top of the iron stream, and cannot go underneath the baffle, it is trapped by the dam and builds up on the surface of the iron in the trough. As it builds up it is carried off through a notch in the side of the trough and drops beneath the cupola into a stream of cold water, where it solidifies in granular form. An automatic conveyor then transports it outside the building to the slag hopper. The hopper is emptied directly into trucks, by gravity feed. The entire operation is thus reduced to minimum handling.

The entire operation requires only occasional attention, to keep the slag-removal notch clear. This is done at infrequent intervals with a slagging bar. The system is not expensive, as the water used is waste water piped from the cupola dust-suppresser units above. It has done away with all the rock wool, dust and grime of the old slagging method. And, instead of requiring two or more men to operate it, the front slagging system occupies only part of the time of one man.



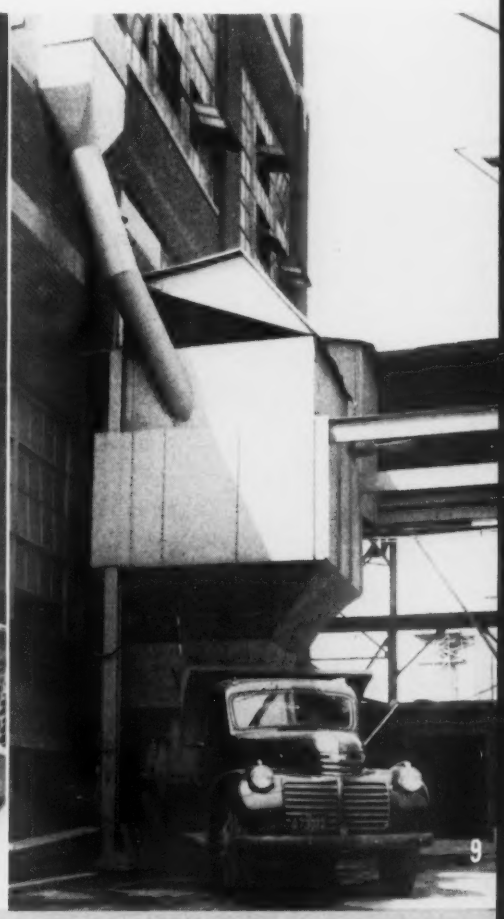


Fig. 8—This conveyor carries the solidified and cooled slag from beneath the cupolas to a hopper located outside the foundry. Water used for slag bath is waste water piped from the cupola dust-suppressor units. Fig. 9—Dropped into this hopper, the granulated slag is removed easily at intervals by truck. The entire slag disposal process is automatic, clean and fast

QUESTIONS and A

Material Is Inoculating Agent

Q.—In an article appearing in a recent issue of FOUNDRY about nodular iron mention is made of percentages of SMZ that are added to various batches. Will you tell us just what that material is, and what purpose it accomplishes?

A.—SMZ, or silicon-manganese-zirconium, is a proprietary product available in two types. One contains 72 to 78 per cent Si, 6 to 8 per cent Mn, 6 to 8 per cent Zr and 5 per cent Fe while the other shows 60 to 65 per cent Si, 5 to 7 per cent Mn, 5 to 7 per cent Zr and 20 per cent Fe. Essentially it is an inoculating agent of the graphitizing type, and is said also to reduce the tendency of gray irons to form chilled edges and corners and wall thickness sensitivity.

Magnesium used in the amounts required to produce nodular graphite acts as a carbide stabilizer, often resulting in a mottled structure in the product. Therefore, some type of graphitizing agent is employed as a ladle addition to eliminate this undesirable structure in nodular irons.

Generic Rather than Specific

Q.—We make plumbers' brass goods using 100 per cent scrap, and have obtained a contract to supply bronze letters for application to buildings. The specification relating to them states that they shall be of statuary bronze, have a dull finish and painted with two coats of lacquer. Can you suggest the alloy, and how to supply the dull finish?

A.—Statuary bronze is a term that is generic rather than specific. It pertains to a series of alloys and not to one. For example, the statue of Napoleon I was made of an alloy containing 75 per cent Cu, 3.0 per cent Sn, 20 per cent Zn, and 2 per cent Pb; one of the Augsburg statues contained 94.74 per cent Cu, 1.64 per cent Sn, 0.54 per cent Zn, 6.24 per cent Pb, and 0.71 per cent Ni, and the Column Vendome 89.2 per cent Cu, 10.2 per cent Sn, 0.5 per cent Zn, and 0.1 per cent Pb.

One foundry specializing in statuary employs an alloy containing 90 per cent Cu, 7 per cent Sn and 3 per cent Zn, but may vary the composition to some degree for various reasons. According to Vickers in *Metals and Their Alloys,* long out of print, d'Arcet claimed the best statuary alloy contained 78.5 per cent Cu, 10 to 18 per cent Zn, and 2 to 4 per cent Sn. Hence, unless the customer will designate a specific composition you have a wide choice in meeting the term "statuary bronze."

As far as the dull color is concerned, we believe it means a patina or color developed by use of ammonium polysulphide solution. Application of that will result in colors ranging from a light brown to black, depending on the amount of sulphide in the solution, length of time of immersion, temperature of the solution, amount of scratch brushing, etc. Preparatory to immersing in the sulphide bath, the castings must be cleaned by dipping in an alkaline bath and rinsed in running water, preferably hot. They then are immersed in the sulphide bath containing 2 oz of commercial ammonium polysulphide per gallon for a few seconds. If the color is not deep enough, the immersion is repeated. Colored castings are dried in sawdust, and scratch-brushed dry—then coated with lacquer.

Dry Sand Molds Scab and Blow

Q.—We make centrifugal pump castings ranging in weight from 150 to 4500 lb. The molds are made in dry sand, half new and half old sand, with addition of bentonite and core compound. We have trouble with blows and scabs. We shall appreciate information on a suitable sand mixture, also on the proper method of preparing and applying blacking mixed with molasses water.

A.—Sands varying widely in physical and chemical properties serve satisfactorily in dry sand molds. In fact, one of the primary reasons for drying the molds is to offset certain features that would prevent the sand from serving satisfactorily in the green or undried state. Excess moisture in the sand is one of the principal causes of scabs and blows on the casting. Drying the mold removes this hazard. However, the mold must be dried thoroughly. A half dried or partly dried mold actually is more dangerous than a green mold, because the hazard is not suspected.

Low permeability is a prolific cause of scabs and blows either in a green sand or a dry sand mold. Leaving generalities to one side and considering your present problem, we are inclined to the opinion, based on your sketchy description, that your sand is too low in permeability, or to use the shop term it is too "tight." This tightness, in turn, is caused by original high clay content or by the addition of both bentonite and core compound. Either one should be sufficient. There is a possibility that the vent is not getting away freely from the mound of sand that forms the inside of the half pump body castings. It may be necessary to vent the sand with a wire and, in extreme cases, especially in the larger sizes, with a riddle full of small coke.

In former times every molder mixed his own wet blacking. This no longer is necessary. Blacking prepared and distributed by reputable foundry supply houses is ready for use when mixed with molasses water or any water soluble binding agent. It is not

Answers

necessary to doctor it with clay or other bonding agent. It should not be mixed too "strong." A pint of molasses is sufficient for a pail of water. Excessive additions of bonding agent will cause the blacking to curl and break in contact with the hot metal.

Skill Needed for Mold Design

Q.—We would like to find a reference book on the design and operation of permanent molds to make aluminum castings.

A.—We regret that we do not know of any book relating to design and operation of permanent molds. While a few articles have been published on permanent mold casting, they do not go into mold design except in an extremely limited way. In general, it may be said that design of molds is based mainly on experience. Basically the design of the mold should be such that the casting begins to freeze or solidify at the points farthest from the gate, and then solidify progressively to the gate which is last to freeze.

To attain that result it may be necessary to heat or cool certain mold sections. While theoretically the ideal mold would follow the contour of the casting with section thickness varying with the casting, that seldom is possible since the mold must be rigid and contain projections for hinges, etc. for opening and closing the mold parts. Likewise, in operating molds certain skill and experience is required. The mold face usually is coated with a refractory to prevent sticking of the casting as well as to protect the face. Also, thickness of the coating is adjusted in various areas to increase or decrease the rate of cooling.

Rough Surface on Lamp Posts

Q.—The skin on some of our ornamental lamp post castings is comparatively rough, apparently from burned-on sand. Facing sand is made up of 12 parts old sand, 4 parts new sand, 1 part sharp sand, 1½ parts seacoal. The molds are sprayed with wet blacking and dried with an oil torch. Each casting is poured through a single runner with metal that is not too hot. We shall appreciate any information on how to produce a smooth skin on these castings. We are forwarding samples of sand and blacking for your inspection.

A.—From an examination of the materials supplied and the information conveyed we should say that the blacking is too light and fluffy and probably applied too thin to the mold face. Black sand and facing sand are quite satisfactory. If you were making the molds in green sand we might suggest a finer grade, but since the molds are skin dried the relative fineness of the sand grains is not important. It is possible that the workmen are hurrying over the job and do not dry the molds properly. If that is the case the cause of the rough castings is apparent. The obvious remedy is to have some person in authority examine each mold before the core is set, and before the mold is closed.

An oil torch will dry a mold properly only if it is applied intelligently. It is a dangerous device in the hands of a careless operator. Careless manipulation of the air and oil valves may produce an unburned oil spray. Following an examination of any given part of the mold it is impossible to decide whether the mold is damp on account of water in the sand, or if it is oil soaked. An intense flame directed too long at one area may give the impression that the mold is dry. Actually when the flame is withdrawn the dampness from the back may creep to the face. The blacking should be well stirred before it is applied. If that does not produce a smooth skin, it may be advisable to use a better grade of blacking.

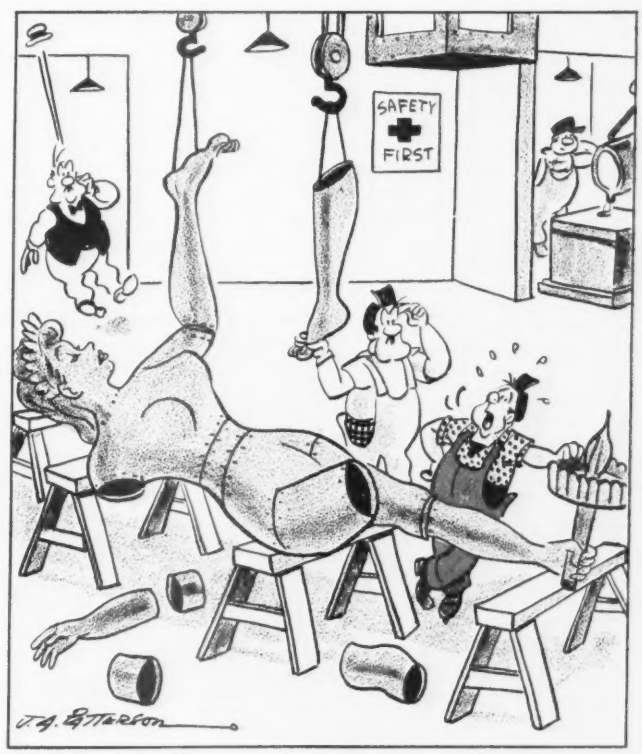
Information on Stack Molding

Q.—Where can we obtain information in regard to stack molding of gray iron castings?

A.—The term stack molding is applied to foundry operations where the molds are placed vertically on top of each other with a common central sprue feed-

GANGWAY!

By J. A. PATTERSON



"I'm willing to say to Hell with it, if you are!"

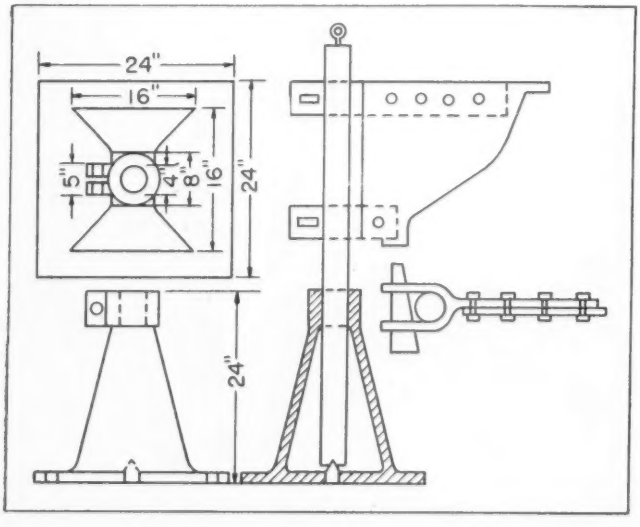
ing the cavities. Additionally the cavities are in the upper face of the mold with the flat bottom of the succeeding mold in the tier forming the cope. Sprue hole in bottom mold is plugged to prevent escape of metal, and the cavities in the top mold are wasted. Multiple molding is similar except that half the cavity is in the bottom of the mold and half in the top so that top of one mold and the bottom of the succeeding mold are required to form the complete cavity.

Machines used for mold production usually are the jolt-squeeze type, and in the case of multiple molding, a half pattern is mounted on the squeeze head in addition to the half on the platen. Number of molds forming a stack will depend largely on the depth of the flask since the deeper they are, the fewer the number required to bring them to a convenient pouring height. Since stack or multiple molding involves a comparatively large body of sand, close attention should be paid to its conditioning. Sand should be open enough to permit easy escape of the gases generated by contact of the molten metal.

Design Improved Spindle Seat

Q.—In the near future we expect to set up a spindle for sweeping large loam molds. We shall appreciate an opinion on the best type of spindle and seat, a device that will remain vertical under hard usage and produce molds that are truly round with the inside and outside walls concentric, another way of saying we want castings with a uniform thickness of metal.

A.—Several years ago the late George Boys, at that time in charge of a foundry where large sugar mill castings—steam belts and evaporators—were made in loam molds, designed and installed an improved type spindle seat as shown in the accompanying illustration. The rig needs no wall supports, may be bolted to a seat or bottom plate and may be erected either in a pit or at floor level. All that is required is to place it where needed, level the top and make it immovable. It may be placed in a hole in the floor or in a flask where sand may be rammed around it. This treatment is not necessary where it is bolted to a plate. The spindle is picked up by the eye bolt at the top and lowered into the holder. When the mold is finished the spindle may be lifted out and taken away until needed again. The spindle adjusts itself accurately in place without any measuring or adjusting by the molder. It is readily apparent that with no wall attachments to get out of plumb, the spindle always is reliable, irrespective of the number of times it is removed and replaced.



Views showing details of spindle holding device

In the shop where the device was introduced, several holder castings were made and finished in the machine shop. The bearing was bored out to fit a 4-in. diam spindle. The top was faced so that a level could be applied. A short, tapered steel pin was driven into a hole in the center of the bottom flange. The spindles were trued in the lathe, cut to desired length and a small tapered hole drilled in the bottom end to fit over the tapered steel pin. The spindles in lengths of 6 and 10 ft have been in almost constant use for several years and give perfect satisfaction. Castings have been truly round, an important factor where a number are built up to form the finished assembly and where the flanges must be accurate in thickness and dimensions.

Plaster Unsuited for Iron

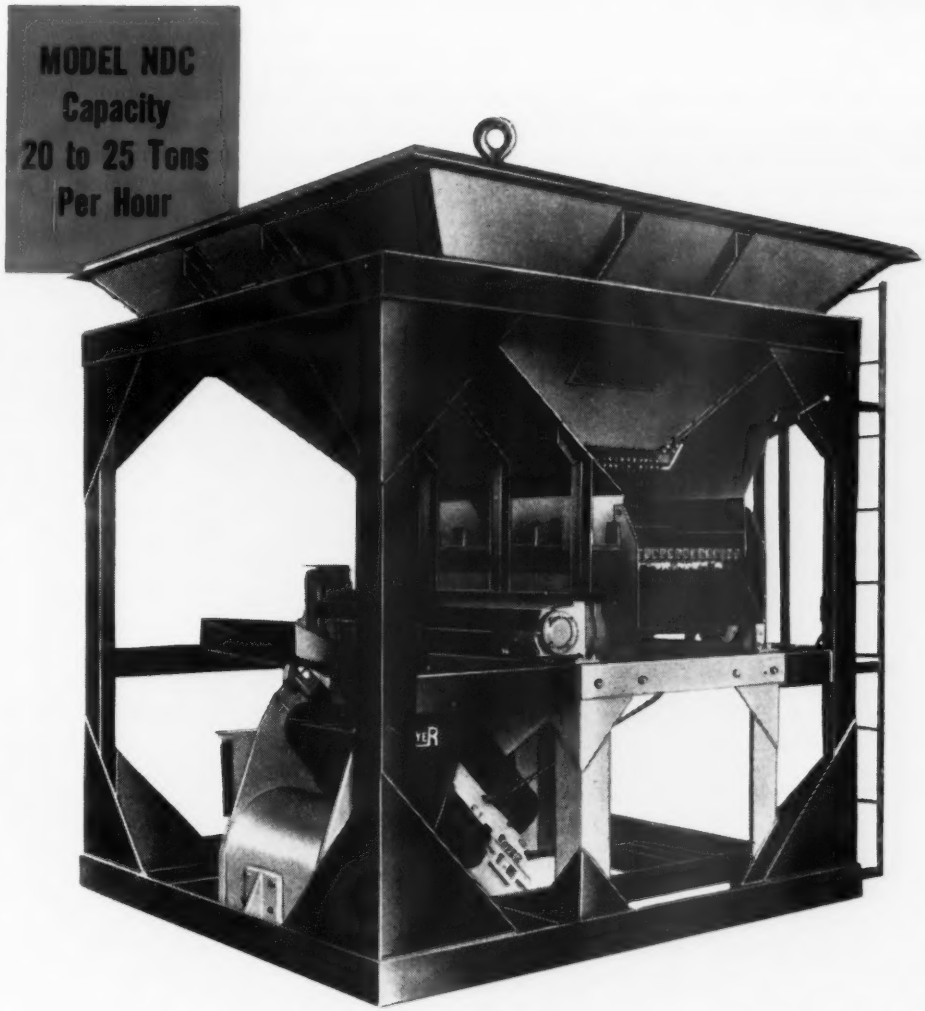
Q.—We are trying to find a short cut to eliminate excessive cost of cleaning cast iron matchplates cast in sand, and it seems to us that we saw reference to a commercial plaster of paris product which would serve. It was said to be porous enough for iron castings with the right setting time, and also smooth enough to give a clean finish for the reproduction of the matchplates.

A.—So far as we know the application of plaster of paris or casting plaster compositions is limited to nonferrous alloys whose pouring temperature is not over 2300°F for thin sections. Where sections are heavy the pouring temperature should not be over 2000°F as chemical decomposition of the plaster occurs, resulting in rough surfaces. Hence, that material cannot be used for producing gray iron matchplates. However, if you want to experiment, metal casting plasters may be obtained from several sources.

For higher melting point alloys the investment molding or so-called precision process is employed, and special refractories which are rather expensive, are used.

It appears to us that if trouble is encountered in cleaning your iron matchplates, use of a fine-grain facing sand containing a small amount of seacoal will provide the desired surface as well as good peeling. Coat of facing sand should not be too heavy as it lacks permeability and may cause blows. As an added precaution for fine surface finish, shake on some

(*Concluded on page* 142)



Proper Sand Conditioning for Better Castings!

Proper sand conditioning is a major step in the improvement of casting quality. Castings made with molding sand that has been thoroughly separated and blended require less machining and cleaning time. You will have fewer rejects due to blows, skids and runouts . . . surface inclusions and rough surfaces are largely eliminated.

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QUESTIONS *and Answers*

(*Concluded from page* 140)

blacking from a bag over the mold face, and then place the pattern back and rap it down carefully. That operation, known as "stamping-back," forces the blacking more tightly into the mold face, insuring a smooth face on the casting.

Melting Rate of Cupola Is Low

Q.—We are operating a cupola lined to 21 in., and are having trouble with slow melting as it takes about four hours to melt 3500 to 4000 lb of iron. Cupola has four 4 x 4-in. tuyeres 10 in. above the sand bottom, and the stack extends only 6 ft above the tuyeres. Fan type blower has six blades 5 in. wide and 14 in. in diam, and is driven by a 6-hp gasoline motor. We have tried coke beds from 48 to 60 in. above the tuyeres. At 55 to 60 in. we obtain hot iron, but after an hour's operation the slag begins to bridge over and then plug the tuyeres. We dig the slag out as much as possible, but the slag gets colder and thicker until melting almost stops. Air pressure in the windbelt is 2¾ in. as measured with a glass U-tube. We have tried varying it from 1½ to 4 in., and at the high pressure the blast is so strong it holds the slag above the tuyeres where it bridges over solid. We use 125-lb iron charges with 15-lb coke splits.

A.—Several points raised in your inquiry require independent answers, and these will be presented individually as well as tracing the interdependence. The melting rate of a 21-in. cupola is 3400 lb per hr based on the usual method of calculation of 10 lb per sq in. of cross-sectional area. Therefore, your melting rate of 3500 to 4000 lb in four hours is extremely slow.

It is almost impossible to calculate the delivery of air from a fan blower since they differ greatly in characteristics, and their capacities depend largely on design and mechanical condition. To obtain the correct information, write the fan manufacturer for a delivery curve. One of the principal factors affecting air volume delivery from a fan blower is the pressure against which it is working. In this instance the windbox pressure is given as 2¾-in. of water. That is quite low for a cupola which normally would be operating at 8 to 10 oz or its equivalent 13 to 17 in. of water. In the range of pressure this fan is operating, it is delivering an excessive quantity of air.

Low back pressure is dependent (in this instance) on the low stock column. Operating height of the cupola (tuyeres to charging door) is only 6 ft. That means if a 60-in. coke bed is used, there is only 1 ft left for the charge, or if a 48-in. bed is employed only 2 ft is left for the charge. In either event the iron is being charged almost directly on the coke bed with no time to preheat. The excessive air also will produce very poor iron.

The amount of air required to melt iron safely is approximately 100 cu ft per lb of coke consumed. At a coke ratio of 7:1 (safe ratio) and a normal melting rate of 3400 lb per hr, this would require approximately 710 cfm delivery from the blower, but at a normal pressure of about 8 oz. This amount of air would require normally about 7½ bhp. At the low back pressure existing, it is believed that the blower is delivering considerably more air than required. Less horsepower is needed at lower back pressures.

To overcome your trouble it is suggested that you (1) increase the stack height by at least 3 to 4 ft, (2) use small coke, possibly 2 to 2½ in. size, (3) try a bed height of 36 in., (4) bosh over the tuyeres, making a ledge of 1 to 2 in. to help keep the slag from the tuyeres, (5) install a slide damper in the air line either ahead of the blower or between blower and cupola. Increasing the stack height and using small coke will increase the back pressure so that more power (than used formerly) will be required and the windbox pressure will go up. This will reduce the air output. Do not change the engine as there may be enough power to deliver the air for the new conditions, (6) coke required at a 7:1 ratio is 18 lb for 125 lb iron, (7) if the material charged is fairly clean do not use over 5 lb limestone per charge.

Venting Required in Open Mold

Q.—We experience a great number of holes in the upper surface of castings poured in open sand. The three other surfaces are free from this condition. Our charge consists of 300 lb No. 2 pig iron, 500 lb complete motor blocks, and 800 lb cupola cast scrap. Surplus iron poured on the ground from cupola or ladles does not show holes, but we do notice that pig iron has similar holes on the surface exposed to the air. Can we make an improvement to our open sand pouring by ladle addition or changing the charging?

A.—Open sand pouring is no panacea for defects in castings although it does eliminate one possible source and the considerable work of making a cope. The fact that one surface of the mold cavity is open to the atmosphere does not mean that the others formed of molding sand can be neglected as far as venting is concerned. The steam and gas formed by contact of molten iron with moist sand must escape, and if it cannot find a passage through the sand, the steam backs up through the metal. In cases where the only small amounts of steam or gas pass up through the molten metal, the upper exposed surface usually is rough and dirty while the other surfaces remain smooth and clean. Where large quantities of gas are developed or if they are produced over a long period of time, the enclosed surfaces of the castings are likely to show blow holes.

In your case it appears that a little more attention to venting the bottom of the mold will eliminate the trouble. The sand is just tight enough to prevent easy escape of the gas, and if you will watch the mold being poured you will notice a small boiling or disturbance of the metal after a few inches have been poured into the mold. It may be that the bottom board is rubbed on too tightly, and substitution of a perforated one may be the answer.

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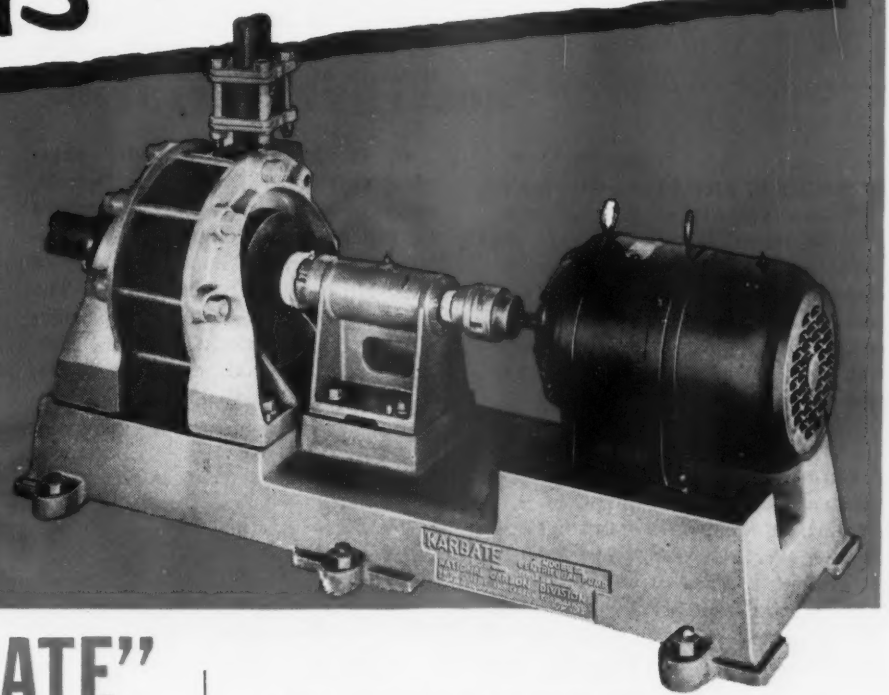

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*Now, even at new low pump prices, "Karbate" rotary seals have been improved. Teflon is used to gasket the seal to the shaft and the gasket is adjusted, independently of pressure, on the seal faces.

OTHER FEATURES:

- All-purpose application
- Freedom from product contamination
- Excellent corrosion resistance
- Rugged construction
- Low maintenance — minimum servicing and replacement of parts

The term "Karbate" is a registered trade-mark of

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UNION CARBIDE AND CARBON CORPORATION
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District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco
In Canada: National Carbon Limited, Toronto 4

BLAST FURNACE LININGS • BRICK • CINDER NOTCH LINERS • CINDER NOTCH PLUGS • SKIMMER BLOCKS • SPLASH PLATES • RUNOUT TROUGH LINERS • MOLD PLUGS • TANK HEATERS

MEN

of Industry

FRED B. SKEATES, who for fifteen years was foundry superintendent, and for the past year personnel director of the Pershing Road plant, Link-Belt Co., Chicago, has been made general superintendent. **Walter Balton,** formerly assistant foundry superintendent, has been named foundry superintendent.

♦ ♦ ♦

Chris A. Zanison has been appointed foundry superintendent, City Pattern Foundry & Machine Co., Detroit. Until recently Mr. Zanison, a graduate of West Virginia University, was foundry superintendent, Warren Alloy & Machine Co., Detroit. Prior to that he was associated with the quality control division, Weirton Steel Co., Weirton, W. Va.

♦ ♦ ♦

William A. Roberts, since 1947 executive vice president in charge of the tractor division, Allis-Chalmers Mfg. Co., Milwaukee, has been elected president, succeeding the late Walter Geist. **W. C. Johnson,** formerly executive vice president in charge of the general machinery division, has been named executive vice president of the company, **J. L. Singleton,** until recently vice president-director of sales, general machinery division, has been made vice president in charge of the division. **Fred Mackey,** previously general works manager, general machinery division, has been named vice president in charge of manufacturing of the division. **R. S. Stevenson,** who has been general sales manager, tractor division, has become vice president in charge of that division. **A. W. Van Hercke,** formerly director of engineering, tractor division, has been named vice president in charge of tractor division engineering. **John Ernst,** formerly general works manager, tractor division, has been made vice president in charge of manufacturing, tractor division.

William E. Mahin, director of research, Armour Research Foundation of Illinois Institute of Technology, has been named director of the metallurgical projects division, metallurgical advisory board, National Research Council. The board, which will advise the Research and Development Board, Department of Defense, on research aspects of critical metals problems, is under direction of **Dr. Robert F. Mehl,** chairman. Mr. Mahin will spend three days a week in Washington, with the remainder of his time devoted to research administration at the foundation.

♦ ♦ ♦

G. W. Merrefield, foundry engineer, Giffels & Vallet Inc., Detroit, recently returned from Italy where he supervised installation of production equipment in the iron foundry of Fiat Mirafiori plant, in Turin. The plant, constructed in 1949 for production of cylinder blocks and iron castings for the Fiat car, under Mr. Merrefield's direction, installed systems involving sand conditioning, molding, conveyor lines, modern shakeout and casting cleaning equipment. While in Italy he visited other plants and attended the Italian Foundry Congress.

♦ ♦ ♦

Benjamin E. Feeley has been appointed manager of production control, Hunt-Spiller Mfg. Corp., Boston, succeeding **R. G. Fredette,** resigned. For the past 2 years Mr. Feeley has been an industrial engineer with Frederick L. Harrison, Los Angeles. Prior to that for 5 years he was in production control work with General Electric Co.

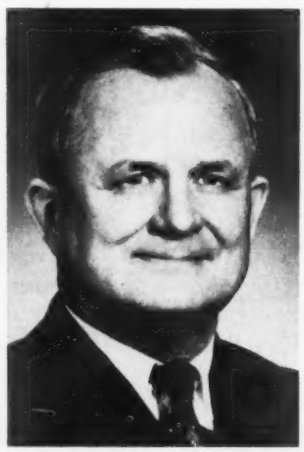
♦ ♦ ♦

Orren S. Leslie has been appointed manager of the Beloit, Wis., works, Fairbanks, Morse & Co., Chicago, succeeding **Henry M. Haase** who has resigned. Mr. Leslie, until recently, was associated with the Electro-Motive Division, General Motors Co., La Grange, Ill. He joined GMC 22

(*Continued on page* 146)

FRED B. SKEATES
. . . *gen. supt., Link-Belt*

CHRIS A. ZANISON
. . . *City Pattern Foundry supt.*



WILLIAM A. ROBERTS
. . . *president, Allis-Chalmers*

W. C. JOHNSON
. . . *vice pres. Allis-Chalmers*

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MEN *of Industry*

(*Continued from page* 144)

years ago in the Pontiac Motor Division, and during that service attended the General Motors Institute to complete his engineering training. He was assigned to the Winton Engine Co., now the Cleveland Diesel Division, and after a period in the management and engineering divisions of that company was transferred to the faculty of the General Motors Institute. For the past 15 years he has been in the Electro-Motive Division, where he has held positions of director of safety, superintendent and until recently, plant manager.

♦ ♦ ♦

Aubrey J. Grindle, recently vice president, Whiting Corp., Harvey, Ill., has been named chief of the Foundry Equipment and Supply Section, Machinery Division, National Production Authority. Mr. Grindle, who originated the first successful system for melting malleable iron with pulverized coal, was manager of the pulverized coal department, Grindle Fuel Equipment Co., Harvey, Ill., when it became a subsidiary of Whiting. For a while he headed his own company, Grindle Fuel Equipment Co., Harvey, Ill., then returned to Whiting Corp. in 1941. He became manager of the foundry equipment department in 1945 and vice president of foundry equipment sales in 1947. Six months ago he succeeded the late A. W. Gregg as consulting metallurgical engineer.

♦ ♦ ♦

R. A. J. Wellington, since 1949 general sales manager, Precision Metalsmiths Inc., Cleveland, has been named vice president in charge of sales. Prior to joining the company in 1945 as Cleveland salesman, Mr. Wellington was associated with the machine tool industry for 20 years. **Richard W. Devans,** vice president in charge of purchasing, has been named treasurer and assistant to the president, **Robert R. Miller.**

♦ ♦ ♦

Dora Ostroff was recently elected president, Thomas Paulson & Son Inc., Brooklyn, N. Y. Miss Ostroff, who has been associated with the Paulson foundry for the past 18 years, started as a secretary in 1932 and after steadily increasing her practical knowledge of the industry, became manager in 1941. Since the death of William E. Paulson last May, she has been in complete charge of company activities. The company, organized in 1883, is one of the oldest nonferrous foundries in the country.

♦ ♦ ♦

Earl Logsdon, coremaker, the Hamilton Foundry & Machine Co., Hamilton, O., has been made foreman of coremaking. **George Krumlauf,** foreman of core assembly, has been transferred to the office of chief metallurgist in the engineering department.

♦ ♦ ♦

Dr. John F. Thompson, president, the International Nickel Co. of Canada Ltd., has been elected to the additional office of chairman of the board of directors, succeeding the late Robert C. Stanley. **Dr. Paul D. Merica,** executive vice president and a director, has been made a member of both the executive committee and the advisory committee of the company. Dr. Thompson, who joined the company in 1906 as metallurgist, from that time until 1918 was in charge of all research and technical activities on Monel and malleable nickel and head of all field and outside plant operations. He became manager of operations in 1921, assistant to the president in 1928, a director and member of the executive committee in 1931, vice president in 1932, executive vice president in 1936 and a member of the advisory committee in 1937. He succeeded Mr. Stanley as president in 1949.

♦ ♦ ♦

William F. Weinreich, formerly assistant superintendent of machine shops at the Buffalo plant, Worthington Pump & Machinery Corp., Harrison, N. J., has been put in charge of its newly acquired Oil City, Pa., plant, where he will be assistant to **Austin C. Ross,** vice president, who is in administrative charge there, in addition to being in charge of the Buffalo plant. Mr. Weinreich, who was graduated from Prof. Egerer's Institute of Technology, Munich, Germany, in 1922, came to the United States in 1925. He joined Worthington's Buffalo plant in 1930 and has been assistant superintendent of machine shops since 1941.

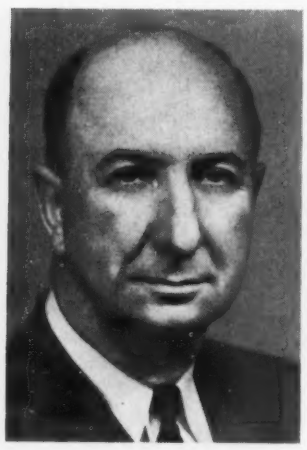
♦ ♦ ♦

Harry K. Clark, president, the Carborundum Co., Niagara Falls, N. Y., who was previously appointed vice chairman of production management for the Munitions Board, Washington, has been named executive vice president. **Cornelius W. Middleton,** Babcock & Wilcox Co., New York, has been appointed vice chairman for production and requirements.

♦ ♦ ♦

Thomas W. Teetor has joined the engineering staff of Swayne, Robinson & Co., Richmond, Ind. Mr. Teetor was graduated from Purdue University in 1948, when he joined the Columbus Malleable Iron Co. He spent the past two and a half years at its plants in Columbus, Cleveland and Ashtabula, O., in foundry work,

(*Continued on page* 148)



AUBREY J. GRINDLE
. . . foundry supplies chief, NPA

R. A. J. WELLINGTON
. . . V. P., Precision Metalsmiths

RICHARD W. DEVANS
. . . Precision Metalsmiths Aide

DORA OSTROFF
. . . heads Thomas Paulson

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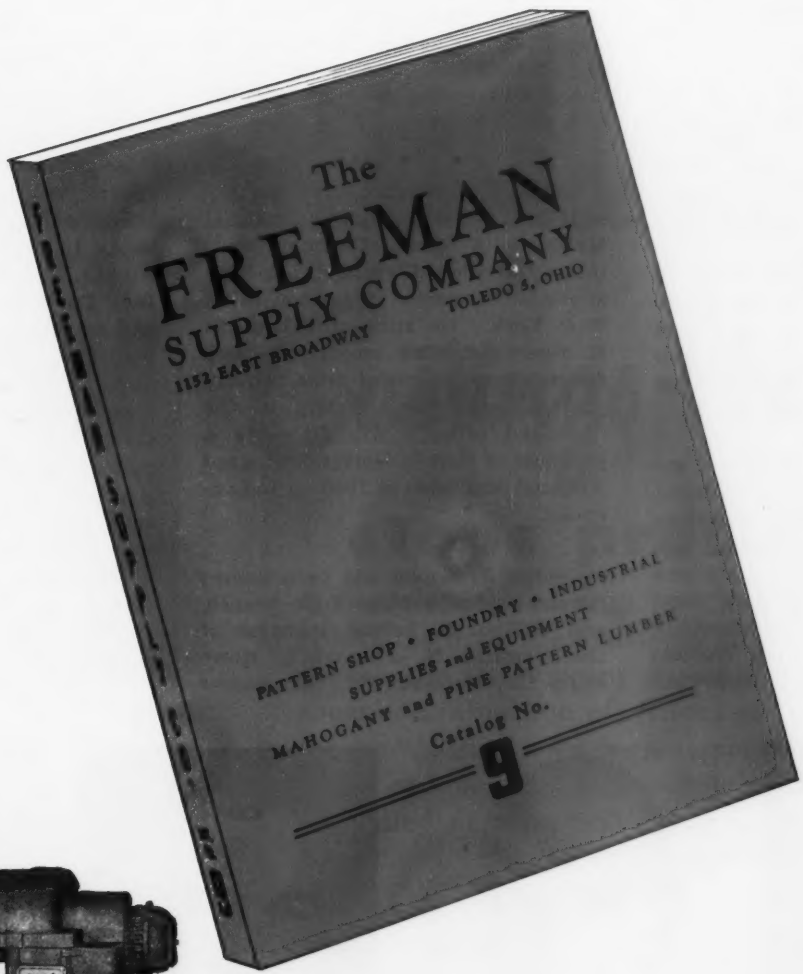
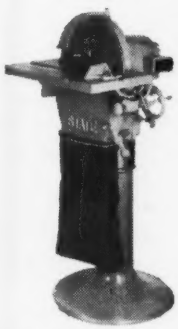
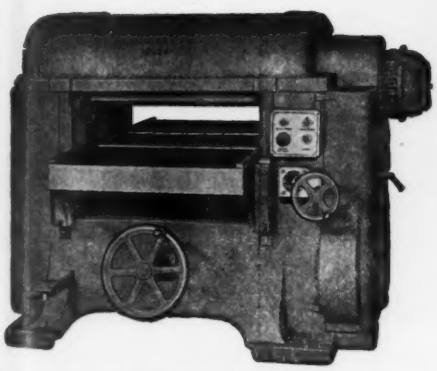


Hi-Speed Wood Router



15" to 36" Disc Sander



13"-16" & 24" Planer

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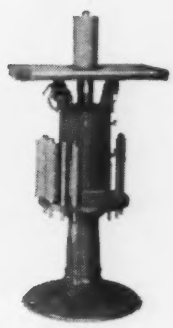
Pattern Plate



Spindle Sander

MEN *of Industry*

(*Continued from page* 146)
costs, standards application and special projects.

♦ ♦ ♦

Osborne J. Stoudt, since 1946 a member of the sales department, Brumley-Donaldson Co., Los Angeles and San Francisco, has been made sales manager of the Los Angeles division. Mr. Stoudt, who entered the foundry industry in 1935, when he joined Washington-Eljer Co., Los Angeles, became associated 5 years later with General Metals Co., there. Following 4 years of military service he returned to Los Angeles and joined the sales staff of Brumley-Donaldson. He is chairman of the entertainment committee of the Southern California Chapter of the AFS.

♦ ♦ ♦

A. William Fraser, has been appointed midwest sales manager, Worthington Pump & Machinery Corp., Harrison, N. J., with headquarters in Chicago, directing sales in Chicago, St. Paul, Kansas City and St. Louis. A graduate of Northeastern University, Mr. Fraser joined Worthington in 1929 and became sales engineer in various of its offices and plants. in 1937 he became Chicago district manager and in 1945 general European manager.

♦ ♦ ♦

John T. Monahan has been appointed assistant sales manager, safety products division, American Optical Co., Southbridge, Mass. Mr. Monahan received a bachelor's and master's degree in chemistry from Holy Cross College and certificate in industrial engineering from Worcester Polytechnic Institute. Following work in research and as an instructor at Holy Cross College, he joined American Optical Co. in 1943 and worked on respirator development. In 1946 he was transferred to the safety sales division, becoming manager of respirator and specialty sales two years ago.

♦ ♦ ♦

William R. Rogers has been transferred to the Philadelphia sales district office, the Carborundum Co., at Bristol, Pa., from the Refractories Division at Perth Amboy, N. J., to act as refractories engineer. Mr. Rogers joined the division following graduation from Cornell University in 1948.

♦ ♦ ♦

Chester F. Delbridge has been appointed general sales manager, the K-G Equipment Co., with headquarters at 50 Broadway, New York. The company, formerly the K-G Welding & Cutting Co., there, makes welding and cutting torches and related equipment. Mr. Delbridge joined K-G—a unit of Air Products Inc.—six months ago after spending 20 years with Air Reduction Sales Co., New York.

♦ ♦ ♦

Donald F. Kittredge, until recently assistant sales manager, National Malleable & Steel Castings Co.'s railway division, Cleveland, has been appointed manager of division sales, New York. He succeeds **Ellsworth H. Sherwood,** who recently became assistant vice president-sales, railway division, with headquarters in the Cleveland office. Mr. Kittredge a graduate of Cornell University, joined National Malleable in 1946, in Indianapolis.

♦ ♦ ♦

George A. Seaver has been named manager of the New York branch, and **William H. Leland,** manager of the Newark, N. J., branch, Howe Scale Co., Rutland, Vt., Mr. Seaver was formerly president, Roberts Numbering Machine Co., Brooklyn, N. Y., and Mr. Leland has been active in the New York and Newark branches of the company for several years.

♦ ♦ ♦

William K. Honan has been appointed regional manager, All-State Welding Alloys Co., White Plains, N. Y., to direct sales and service in New England, New York north of Westchester county, western Pennsylvania and Ohio.

♦ ♦ ♦

Thomas W. Campbell, Poland, O., and **E. D. Cowlin,** Canton, O., have been named directors of Electro Refractories & Abrasives Corp., formerly Electro Refractories & Alloys Corp., Buffalo. Mr. Campbell is a sales engineer for the company in the Youngstown, O., area. Mr. Cowlin is general manager of the Reliance Division, Eaton Mfg. Co., Massillon, O.

♦ ♦ ♦

Victor B. Bethany has joined the sales engineering department, Ohio Steel Foundry Co., Springfield, O. Mr. Bethany was graduated from Case Institute of Technology in 1944 and worked as a student engineer at Westinghouse Electric Corp., Cleveland. Later he was associated with Alten's Foundry & Machine Works Inc., Lancaster, O., as metallurgist, and as sales engineer with Columbus Malleable Iron Co., Columbus, O.

♦ ♦ ♦

C. H. Wills has been named director of sales, Michigan Abrasive Co., Detroit. **Barnard S. Meade,** until recently, vice president-general manager, American File & Swiss Tool Co., Newark, N. J., succeeds Mr. Wills as sales manager.

♦ ♦ ♦

Charles Morrison has resigned as general manager, Benton Harbor

(*Concluded on page* 151)

OSBORNE J. STOUDT
. . . Brumley-Donaldson sales

A. WILLIAM FRASER
. . . Worthington sales, Chicago

JOHN T. MONAHAN
. . . American Optical sales

WILLIAM R. ROGERS
. . . Carborundum Co. sales

Above: Bartlett-Snow Apron Conveyor Handling Castings from the Shakeout in a Large Production Foundry.

Shakeout in Large Southern Foundry Showing Dust Hood and Castings Handling.

Apron Conveyor in Cleaning and Inspection Departments in a Large Midwestern Malleable Foundry.

Castings Handling

stops profit leaks

● Bartlett-Snow castings handling and cleaning systems reduce the time—and cost—of handling castings from the shakeout to the shipping room. They permit the cleaning room and inspection operations to be synchronized to the tonnage passing over the shakeout — eliminate rehandling — and produce a controlled flow of castings, similar to the controlled flow of molding, pouring and cooling made possible with a run-around mold conveyor.

Complete facilities including casting coolers. The C. O. Bartlett & Snow Co., 6201 Harvard Ave. Cleveland 5, Ohio.

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BARTLETT-SNOW CLEVELAND 5, OHIO

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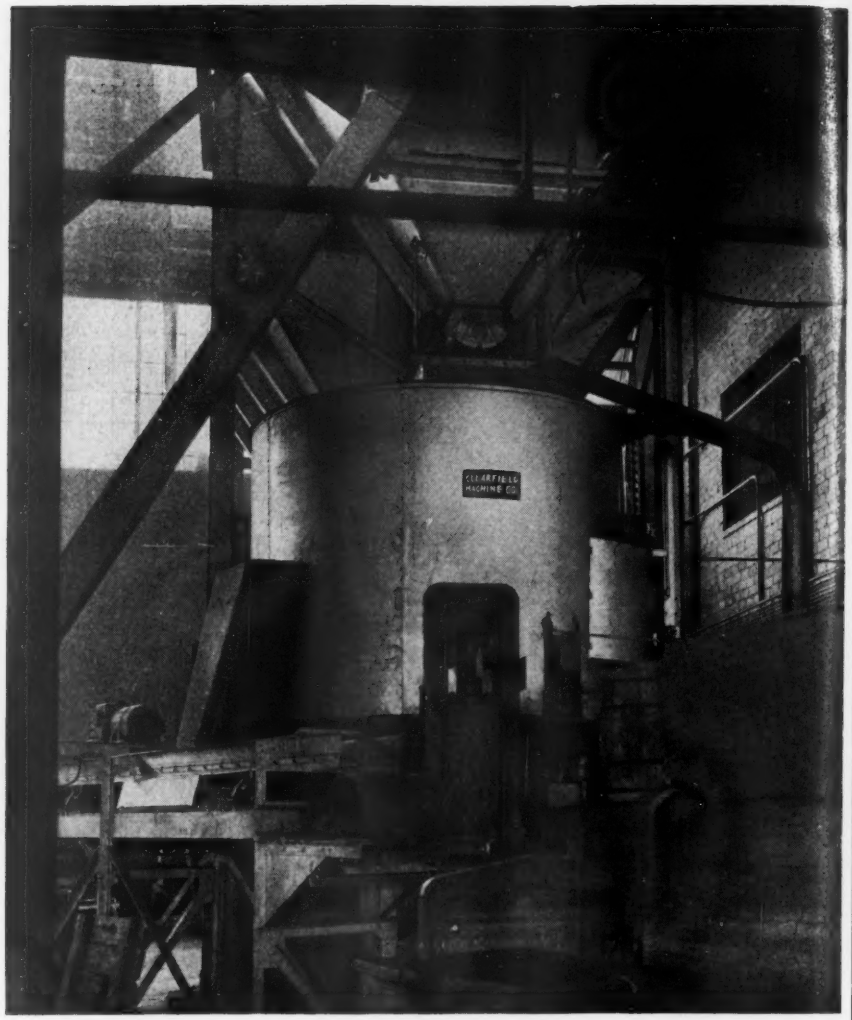
you get
better
foundry sand
from a

CLEARFIELD
MIXER



This Clearfield 930 Mixer is the center of a complete molding sand conditioning system.

Sand which adheres firmly during both molding and pouring operations must have bond and moisture uniformly distributed. This is absolutely essential for good foundry work—and that's the type of sand which is turned out all the time by Clearfield Mixers.

Clearfield Mixers, with the famous revolving pan and vertically rotating mullers, are available in sizes and models to fit in perfectly with any production setup. So whether your needs are for small quantities of sand at infrequent intervals or a continuous large supply, write for Catalog No. 79 for complete information on the Clearfield Mixer which you require.

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AERATES

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RUSSELL F. LaBEAU

Vice president in charge of engineering, Sutter Products Co. Reported in March FOUNDRY

RALPH R. NEWQUIST

Executive vice president, Roots-Connersville Blower Corp., as reported in March FOUNDRY

ROBERT H. OWENS

New president-general manager, Roots Connersville Blower Corp. Reported in March

(*Concluded from page* 148)

Malleable Industries, Benton Harbor, Mich., and plans to spend the summer at his camp at Iron Bridge, Ont. In the fall he will re-enter the manufacturing field as a consultant.

♦ ♦ ♦

Richard E. Coe has been named assistant to the president, the Electric Furnace Co., Salem, O. Mr. Coe, formerly a fuel engineer for the company, more recently has been a district manager for North American Mfg. Co., Cleveland.

♦ ♦ ♦

Donald A. Campbell has been named vice president in charge of engineering and research, Eclipse Fuel Engineering Co., Rockford, Ill. Until recently he was with Bryant Heater Division, Affiliated Gas Equipment Inc., Cleveland, as manager of the industrial division, specializing in gas combustion equipment. Prior to that he was with Wheelco Instrument Co., Chicago, as New York district representative. A graduate of Colorado Engineering School, Mr. Campbell was associated with Eclipse Fuel from 1929 through 1939 as a gas combustion engineer.

♦ ♦ ♦

Prof. C. T. Marek, Purdue University, has been invited to present a paper on "Casting Design for Economical Production" before the annual meeting of the American Society for Engineering Education to be held at Michigan State College, June 25.

♦ ♦ ♦

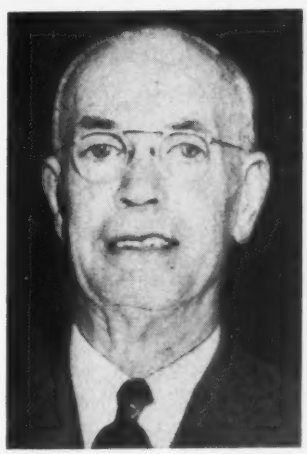
R. J. Foresman, recently named assistant secretary, Mid-West Abrasive Co., has also been appointed assistant general sales manager, with headquarters at the executive offices in Owosso, Mich.

♦ ♦ ♦

Frank R. Hunter has been named manager of the Wichita, Kans., office recently opened by general machinery division, Allis-Chalmers Mfg. Co., Milwaukee. Mr. Hunter, a graduate of Kansas State College, joined Allis-Chalmers in 1940 and has been a sales representative since 1942 in the Kansas City district office which will operate the new branch office.

♦ ♦ ♦

George Johnstone Sr. retired from Johnstone Foundries Inc., Grove City, Pa., recently, following 59 years in the foundry industry. Honored at a



GEORGE JOHNSTONE SR.

testimonial banquet, Mr. Johnstone, a native of Tayport, Scotland, cited the opportunities in American foundries today as more abundant than ever before. **George Johnstone Jr.,** president of Johnstone Foundries, reviewed his father's life and activities. Orphaned in early life, he entered foundry apprenticeship at 11 years of age. Following 7 years of apprenticeship, he spent a year with the Royal Guard at Buckingham Palace, London, and returned to the foundry business in Scotland, where he became well known as a master foundryman. Following service in World War I, he came to the United States in 1923 and was associated with Sharpless Separator Co., Cochrane Corp., Pottstown Foundry, John Wood Mfg. Co. and Alan Wood Steel Co. In 1947 he joined his son who had organized the Johnstone Foundries the year previous. The banquet marked the first reunion in 14 years of Mr. Johnstone with his four sons: David K. Johnstone, Roanoke, Va.; James L. Johnstone, Pittsburgh; John MacDonald Johnstone, Philadelphia, and George Jr. of Grove City.

♦ ♦ ♦

R. A. Morris, comptroller, Dominion Foundries & Steel Ltd., Hamilton, Ont., has been elected to membership in the Controllers Institute, New York, an organization of controllers and finance officers from all branches

♦ ♦ ♦

Anthony J. Zino Jr. has been named assistant to the president, Swan-Finch Oil Corp., New York. He was formerly sales promotion manager and chief lubrication sales engineer for the company and is a past vice president of the American Society of Lubrication Engineers.

♦ ♦ ♦

Ancel C. Adams has been appointed general plant superintendent, the Cleveland Crane & Engineering Co., Wickliffe, O. Mr. Adams, who has been with the company for 28 years, has served as manager of the shipping, receiving and stores department, traffic manager, and assistant plant superintendent.

♦ ♦ ♦

Towner K. Webster has been made chairman of the board of the Hydro-Blast Corp., Chicago. **Roderick S. Webster** has been named president; **Robert K. Strong,** vice president and treasurer; **D. H. Petty,** vice president, and **Ronald Webster,** secretary. **Paul H. Dunakin,** executive vice president, has retired and will devote his time to private law practice.

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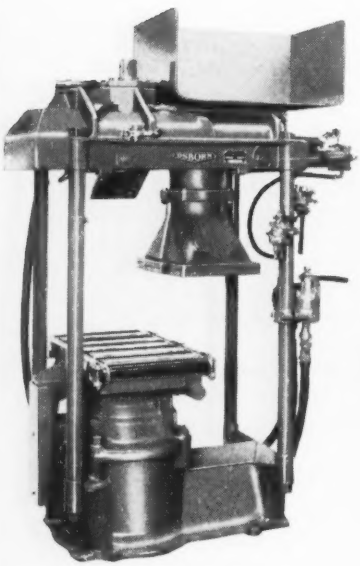
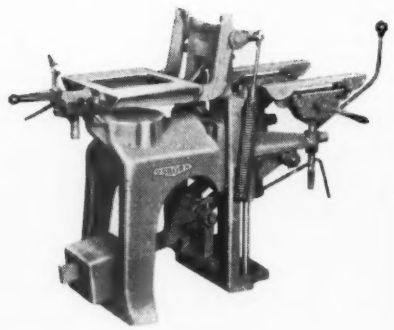
• CORE BLOWERS
Manual or Automatic Controls

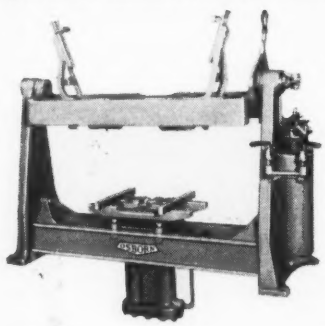


Draw Piston Type

Diaphragm Type

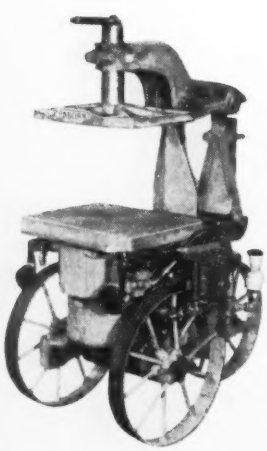


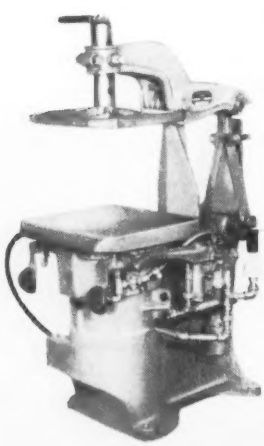
Hand Operated Rockover Core Machine

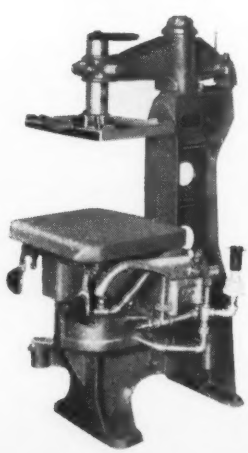


Core Box Rollover Drawing Machine

• SQUEEZERS
Portable or Stationary—Cantilever or Post Type







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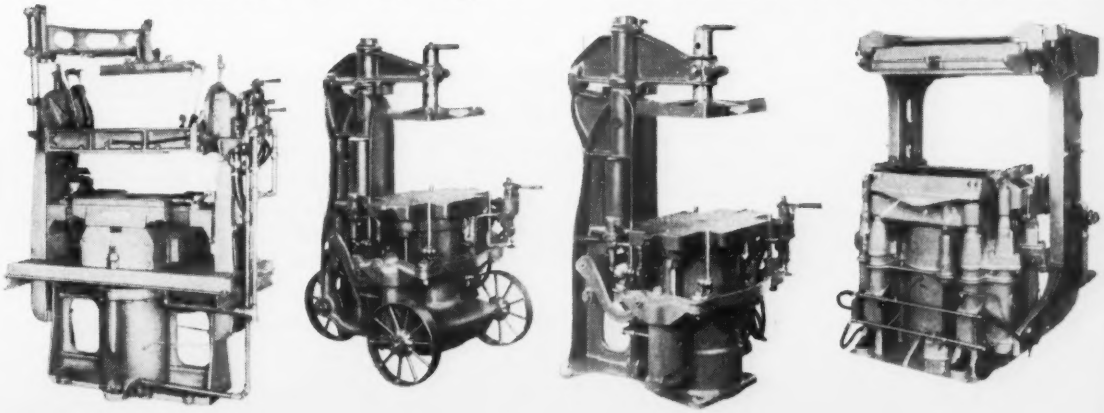
JOLT ROLLOVER SQUEEZE JOLT SQUEEZE STRIPPERS



ROFT

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MOULDING MACHINES CORE BLOWING MACHINES

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

Principles of Risering

By CHARLES F. WALTON, Case Institute of Technology, Cleveland

of Foundry Practice

RISERS serve these various purposes in making castings: Venting the mold cavity, absorbing kinetic energy of the metal stream, indicating when the mold is full, acting as a flow-off, and mainly in feeding the casting during solidification.

In venting the mold cavity the riser usually is small in diameter and is termed a "whistler." Its use may be necessary if the casting has a slender cope projection which might misrun if there is a slight mold gas back pressure. Or it may be used to permit escape of air in the mold cavity; this might be important in dry sand or permanent mold work where the coated mold surface or the entire mold has low permeability. However, in green sand molding the volume of air in the mold cavity is a minor percentage of the total volume which must leave the mold. Use of a riser solely to vent the mold cavity will be of value only in the presence of low mold permeability, and that difficulty is better avoided by correcting the sand condition. Whistlers should be small enough to freeze off promptly just before solidification of the casting to eliminate shrinkage or grain size difficulties.

Develop High Pressure

When molten metal flowing in a mold is stopped suddenly, a high pressure is developed due to change in motion, and if there is a whistler on top of the mold a small amount of metal may be thrown high into the air. Hence, risers placed as close as possible to the end of the flow system are used to absorb or dissipate the energy of motion or kinetic energy since distortion of the mold cavity or runouts are common results of that phenomenon. Third purpose of a riser is to indicate when the mold is full. That, of course, is elemental but if properly used in some applications may save molten metal, especially where pouring basins are used on top of the molds. The riser may act as a flow-off for cold metal to avoid a misrun where pouring temperature is limited. An example of this would be a mold containing thin cores with considerable area. Most common reason for using a riser is to compensate for the solidification contraction or shrinkage of the metal. Contraction of metal can be divided into three phases: Liquid contraction; solidification contraction, and solid or linear contraction. Liquid expansion and contraction of metal with temperature is readily evident in the ordinary mercury thermometer. A substance in the liquid state is less dense than when it is solid (water is one of the exceptions) so that when a liquid solidifies there is a decrease in its total volume. This is called solidification shrinkage. The linear expansion and contraction of solids is in daily evidence from expansion joints in bridges and railroad rails, etc. In making castings the solid contraction is provided for by the patternmakers' shrink rule (or occasionally by some plain and fancy rapping of the pattern in the mold).

Factors affecting the solidification contraction in a casting include the metallurgical classification of the metal being poured, the size and shape of the casting, and the risering and gating practice. Much of the variation in risering practice for different metals may be explained by the metallurgical classification of the metal in the way it solidifies.

Pure metals and eutectic alloys solidify at a constant temperature so that in freezing they generally become mushy throughout and then become solid. Soft gray iron is typical of this type of solidification. Solid solution type alloys such as steel and brass solidify over a range of temperature. In freezing, the casting generally forms a solid shell at the surface while the center is entirely liquid. Other casting alloys combine the two, starting solidification over a range of temperature and finishing at a constant temperature. Malleable iron is an example of this. Thus we have a real basis for variations in risering practice with different alloys. Since the solidification takes place differently it is likely that the shrinkage characteristics will vary.

Solidification shrinkage may occur as a general overall porosity, and is characteristic of some of the nonferrous alloys. Metals saturated with hydrogen upon solidifying and containing distributed gas porosity will show little or no external evidence of shrinkage.

Center-line shrinkage is typical of solid-solution type alloys such as steel due to the formation of a solid skin or shell sufficiently strong to resist atmospheric pressure. Opposite to this is the occurrence of cope draws or side wall draws common in principally eutectic alloys such as gray cast iron in which a considerable portion of the metal solidifies last at a constant temperature. Thus the mushy, partly solidified metal will not support the surface of a casting against atmospheric pressure with vacuum in an internal cavity. The result is drawing in of a surface of the casting.

Shrinkage may also be concentrated at hot spots such as may be caused by re-entrant angles or small cores in a heavy section. A relatively thin core—if large enough and mainly enclosed by metal—may expand sufficiently to absorb considerable or, in some cases, all of the solidification shrinkage.

Control Heat Abstraction

The rate at which solidification takes place depends upon heat input, and heat out-go or abstraction. The source of heat to be dissipated is the product of the latent heat of fusion of the metal, which is fixed with a given alloy, and the amount of metal present, which is fixed by the casting weight.

Heat abstraction is controlled by the total area of the mold cavity surface through which the heat can be dissipated and the ability of the mold cavity surface to extract heat. Since the area is fixed with a given casting, the ability of the mold surface to dissipate heat is the most ready variable the foundryman has to work with. He can change this slightly by the way the sand is rammed, but large changes can be produced by using other materials of higher thermal conductivity instead of sand at the surface of the casting. These are commonly called external chills.

In some metals an internal chill is preferred and this cold insert merely absorbs some of the heat of the metal, thus reducing the amount necessary to be dissipated up to the time solidification is complete. Since sand is a relatively poor heat conduc-

(*Concluded on page* 156)

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(*Concluded from page* 154)

tor, heat absorbed in raising the temperature of the surface sand is important. If the sand in a given area has been heated highly during filling the mold, its capacity to absorb the heat liberated from the metal upon solidification is low. Thus the gating of a casting and the resulting flow pattern of the metal have a direct effect upon the solidification of the casting for two reasons. First, it largely determines where the coldest liquid metal—the first to solidify—will be in the cavity. Second, the flow pattern establishes which parts of the mold cavity surface are most and least capable of extracting further heat from the metal.

In gating for directional solidification the metal is generally introduced through or under the riser into the heavier section of the casting so as to produce a definite direction by which solidification will take place, starting at the far side of the casting and progressing right into the riser. Non-directional gating is used when as uniform a temperature as possible is desired throughout the metal in the mold and generally involves the use of multiple gates for uniform metal distribution. In small light castings it is often possible to overcome section thickness differences by gating, but as the castings become larger with heavier sections the flow pattern of the metal becomes less important and the actual thickness and mass of the metal controls the direction of solidification.

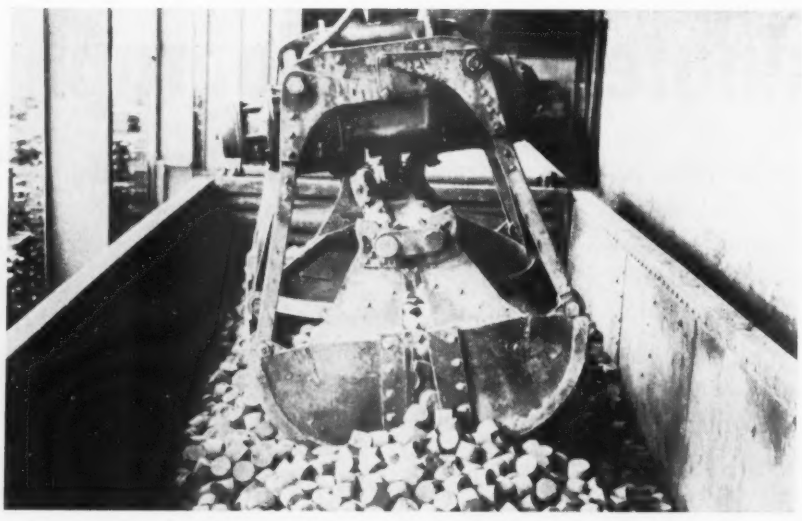
For a riser to properly feed a casting and compensate the solidification shrinkage two conditions must be fulfilled: 1. The riser must stay liquid until the casting is completely solidified. 2. The riser must have the ability to deliver sufficient liquid metal to the casting to make up for the solidification contraction.

The first point, staying liquid longer, is a matter of the effective section size. The effective section of a casting may be defined as the thickness of a flat plate which will solidify at the same rate. With the highly intricate shape of some castings the effective section is difficult to determine. Often the calculation of the surface area to casting volume ratio gives a basis for establishing what would be the effective section, but this must be used with discretion. For example, in the case of a large, thin-wall gear housing the core surface is as useful in absorbing heat from the metal as the external surface. However, a small center core in a heavy hub casting certainly could not be considered an effective surface through which heat can be conducted during solidification.

In fact, a very light core or a thin projection of molding sand into the body of a casting may well increase the effective section of the casting and make it solidify slower than if the casting were not cored or had an irregular surface. This will occur when a core or sand projection is heated to the temperature of the metal by the time solidification begins. The sand is then incapable of absorbing any more heat from the metal by the time solidification begins. The sand is then incapable of absorbing any more heat from the metal by the time solidification beity is very low it insulates the casting and may actually give some heat back to the metal. Thus the effective section of an irregularly shaped casting is often difficult to estimate, but an experienced foundryman often can develop a high degree of skill in this. Where the importance of the job warrants it, the actual cooling rate can be determined by inserting thermocouples into trial castings.

The amount of solidification contraction is, of course, a function of the casting alloy and may vary all the way from zero for very soft gray iron to as high as 8 per cent or more for certain nonferrous alloys. Steel is stated by Briggs to have a solidification contraction of 3 per cent to which some allowance for liquid contraction must be made. Seager and Ash (*Transactions,* American Foundrymen's Society, 1932) determined the variation of solidification contraction with graphitic carbon content. The value for white iron (malleable) is given as 5½ per cent.

In conclusion the principal (but not all) factors required of a riser to successfully produce a sound casting are: 1. A directional solidification pattern must be established in the casting. 2. The riser must be attached to the last part of the casting to solidify. 3. The riser must solidify after the casting. 4. The riser must be capable of supplying sufficient liquid metal to the casting.



FERROALLOY BRIQUETS usually are strong enough to be handled by clamshell bucket. Photo above shows a car of silicon briquets being unloaded at a plant of Caterpillar Tractor Co. Photo by courtesy of Electro Metallurgical Division, Union Carbide & Carbon Corp.

Foundry Manpower Study Scheduled for April

The U. S. Department of Labor will conduct a special survey of foundry manpower the latter part of April. Details of the study have been worked out by the department's Bureau of Employment Security and the Gray Iron, Malleable, and Steel Founders' Societies.

Principal foundries throughout the country will be asked for employment figures by local offices of the State Employment Services, and the data will be assembled for use by various government agencies and the foundry industry. Summaries of the survey will be made available to the foundry societies and foundry establishments. However, information will not be released in any way which will reveal individual plant figures.

The societies expect the survey to provide information which will be useful in discussing the industries' problems with draft officials. Plans for the study include relating manpower information to production figures filed with the Census Bureau and production goals for defense mobilization.

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WHEN YOU MELT. MOORE RAPID *Lectromelt*

Buffalo Welcomes AFS

(*Concluded from page* 103)

gins, Allis-Chalmers Mfg. Co.; Prof. Howard F. Taylor, Massachusetts Institute of Technology; J. B. Caine, foundry consultant; B. N. Ames, New York Naval Shipyard; W. W. Edens, Badger Brass & Aluminum Foundry Co.; Fred G. Sefing, International Nickel Co., and E. C. Zirzow, Deere & Co.

Evening shop courses are scheduled by the Brass and Bronze, Gray Iron, and Sand Divisions. Harry W. Dietert will be discussion leader at the two courses sponsored by the Brass and Bronze Division on the subject of basic approach to sand control. The gray iron course will be concerned with melting practice, subjects for the three sessions being "Air in the Cupola," "Melting in a Reverberatory Type Furnace" and "Metal Pouring Temperature Control." Three sessions of the Sand Shop Course will cover "Malleable Foundry Sand Control," "Shell Molding and Use of Resin Binders" and "Foundry Sand Control."

A number of technical sessions devoted to subjects of general foundry interest are being sponsored by other society divisions and committees. Among these are a session on the subject of heat transfer, one on time study and methods, one on foundry costs, two on plant and plant equipment and one on refractories. Several sessions are planned by the Sand and Pattern Divisions, while the Educational Division is sponsoring an afternoon session and dinner.

Exchange Papers — Three foreign foundry groups are sponsoring exchange papers this year. The official paper from the Institute of British Foundrymen is titled "Basic Cupola Melting and Its Possibilities" and was prepared by E. S. Renshaw, Ford Motor Co. Ltd., Dagenham, England. A paper from the Institute of Australian Foundrymen by R. Dyke, Defense Research Laboratories, Maribyrnong, Victoria, will discuss "The Modification Technique of Aluminum-Silicon Alloys." The third paper, on steel penetration, is from the Metallografiska Institute of Sweden.

Charles Edgar Hoyt Lecture—Another outstanding paper on the program will be the annual Charles Edgar Hoyt Lecture, to be presented by James C. Zeder, director of engineering and research, Chrysler Corp., Detroit, on the subject "The Management of Industrial Research."

Walton L. Woody, national president of the society and vice president, National Malleable & Steel Castings Co., Cleveland, will present his annual address at the business meeting. This session also will include the awarding of prizes in the national apprentice contest and election of AFS officers and directors for 1951-52. Nominees are:

President, Walter L. Seelbach, president, Superior Foundry Inc., Cleveland; vice president, I. R. Wagner, director, Electric Steel Castings Co., Indianapolis. Directors for three years, Martin J. O'Brien Jr., works manager, Symington-Gould Corp., Depew, N. Y.; Harry W. Dietert, president, Harry W. Dietert Co., Detroit; Albert L. Hunt, works manager, National Bearing Division, American Brake Shoe Co., St. Louis; Dr. James T. MacKenzie, technical director, American Cast Iron Pipe Co., Birmingham; A. M. Ondreyco, plant manager, Vulcan Foundry Co., Oakland, Calif. Mr. Woody is nominated as a directed for one year.

Banquet—Program for the annual banquet, to be held at Hotel Statler Thursday evening, will include the presentation of the society's gold medal awards and honorary life memberships to six outstanding foundrymen. Details concerning the recipients are given on pages 108-109. Principal speaker at the banquet will be Dr. Kenneth McFarland, superintendent of schools, Topeka, Kans., and designer and builder of the McFarland Trade School, Coffeyville, Kans.

Ladies Entertainment—A committee selected by Western New York Chapter has made plans for entertainment of lady visitors to the convention. This committee is headed by Mrs. John R. Wark as chairman and Mrs. Alfred A. Diebold as co-chairman; liaison with the chapter is being handled by Leo A. Merryman, Tonawanda Iron Division, American Radiator & Standard Sanitary Corp. The program will open with a reception and tea at Hotel Statler, Monday afternoon. Tuesday a luncheon and entertainment is planned at the Twentieth Century Club. A tour to Niagara Falls, followed by luncheon, is scheduled for Wednesday.

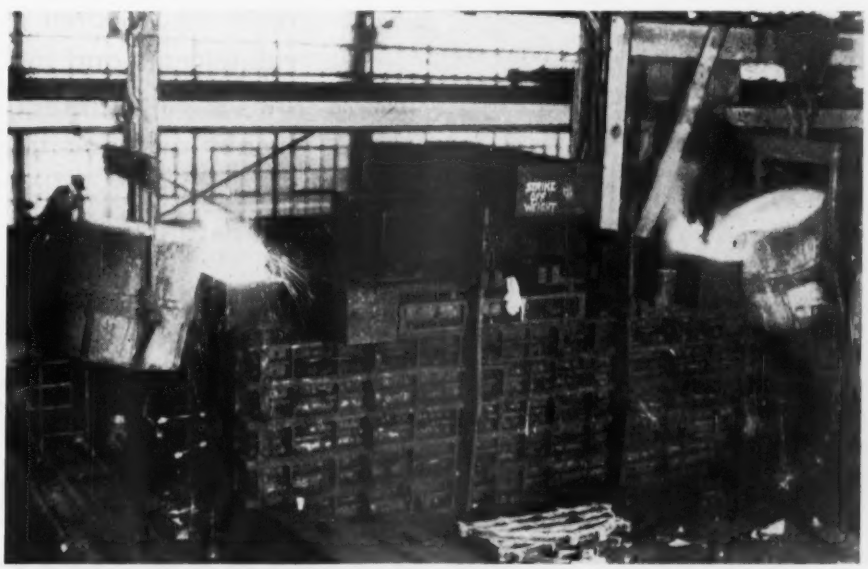
Nonferrous Founders To Meet

Members of the Non-Ferrous Founders' Society will hold two meetings in Buffalo the week of the AFS convention there. The annual meeting of members is scheduled for Sunday, Apr. 22, at the Buffalo Athletic Club. This meeting will feature discussion of price and wage controls affecting nonferrous foundries. An industry dinner also will be held at the Buffalo Athletic Club, Monday, Apr. 23, at 6:30 p.m.

Plant Inspections Scheduled for AFS Visitors

(*Concluded from page* 115)

Institute of Applied Arts and Sciences also will be open to visitors. This school is offering, in addition to various other curricula, a two-year co-operative program to train technicians for the foundry industry. Students are required to spend nine months each year in the school courses, the other three months being spent working in a local related industry. Various types of foundry equipment are available to students at the institute.



Pouring a large gray iron casting at Worthington Pump & Machinery Corp.

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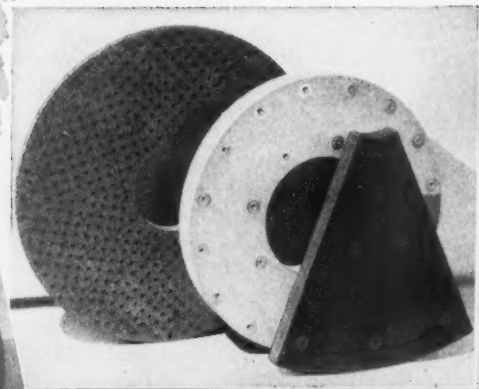

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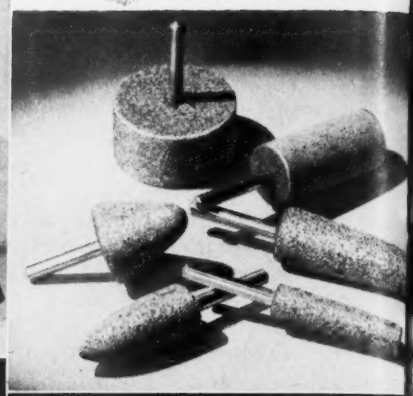

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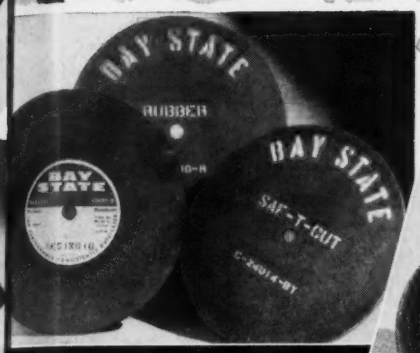

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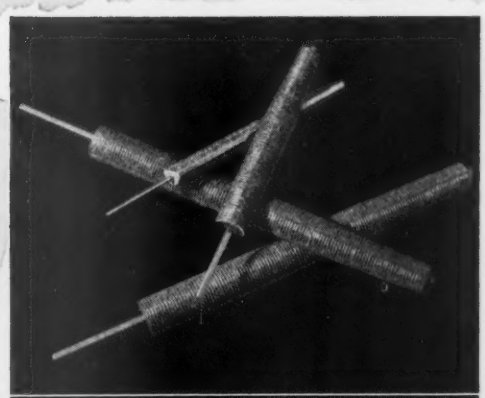

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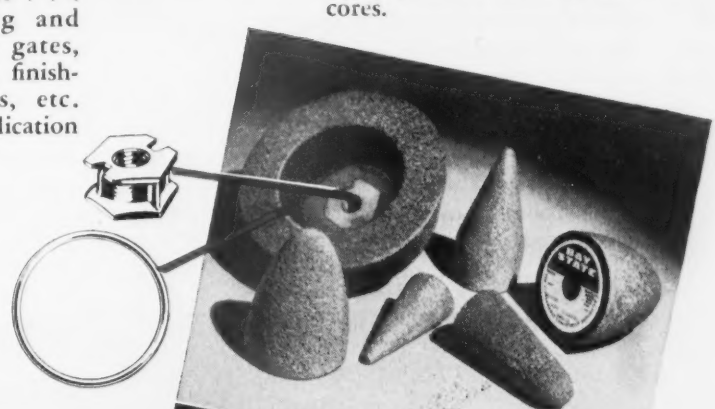

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AROUND THE COUNTRY

CHICAGO—It is now confirmed that Ford Aircraft Division, Ford Motor Co., which is tooling up the World War II Dodge Chicago Plant of Chrysler Corp. here for production of 28-cylinder Pratt & Whitney Wasp Major engines, will operate the magnesium foundry but not the aluminum foundry. The latter foundry, a twin of the magnesium shop, will not be needed because of basic changes in aircraft engine design eliminating aluminum castings.

The aluminum foundry production of Dodge Chicago was confined to only one casting—the complicated finned cylinder head for the 18-cylinder 2200-hp Wright air-cooled engine. The cylinder head for the 4000-hp engine Ford Aviation will make is an aluminum forging, as are also the cylinders and crankcase sections. The magnesium foundry has ample capacity for producing all of the magnesium castings Ford will require for the new engine, consequently the aluminum foundry becomes surplus.

However, because of the country's general shortage of facilities for producing magnesium castings for other aircraft needs, Wright Field, Dayton, O., now is considering converting the aluminum foundry to magnesium. Speculation is that such conversion will be authorized and the go-ahead given soon.

Three Chicago firms, Sherman Olson Inc., Hanley & Co. and Fischbach, Moore & Morrisey, have been granted contracts by Ford for the overall rehabilitation and revision of the existing magnesium foundry facilities. It is understood that the foundry equipment is in reasonably good condition despite 5 years of idleness. Major work involves realignments and additions necessary to meet new casting requirements.

Amendments to the original Ford contract with the U. S. Air Force have raised the estimated value of the contract to approximately $565 million. This is about ten times the value of the original contract. Production is expected within 12 months. Employment presently is in excess of 3000 persons; well over 20,000 is anticipated when peak production is reached.

* * *

PHILADELPHIA — Foundrymen these days have two main problems —adequate material supplies and adequate manpower. The latter is definitely the more troublesome insofar as ferrous foundries are concerned. There is shortage in both pig iron and scrap, but in most instances consumers have been able to obtain enough to keep going. As for coke, the third major raw material item, there is relatively little difficulty and the outlook is encouraging.

Nonferrous foundrymen express greater concern over raw materials, such as copper, aluminum and zinc, than labor, which at present constitutes the greater bottleneck.

Defense work is increasing rather sharply in some lines, such as in steel and malleable castings, and more particularly in nonferrous castings. In fact, it is so difficult to obtain materials that many nonferrous foundries are loathe to accept any other than emergency work which would carry a rating that could be extended for materials. To date gray iron foundries have received little DO-rated tonnage. Some claim their rated tonnage amounts to little more than 2 per cent of their total. Others report up to 10 per cent.

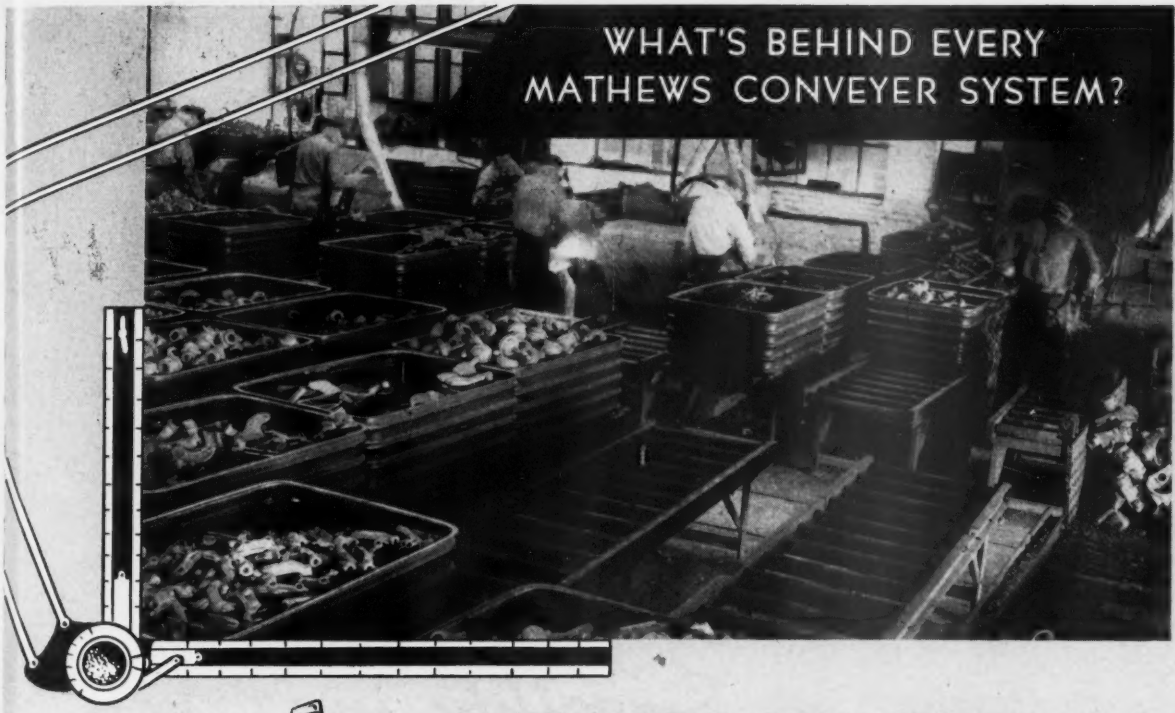
* * *

LOS ANGELES — More often district foundrymen are saying "Up 'til now. . . ." in describing their operations. Many, sensing a point of transition, see a nearby intensifying of their problems. Ahead lies greater casting demand, more regulations, more schedule readjustments — less raw materials and less skilled labor.

While only a few foundries have been at capacity operation, more are approaching that condition. A few steel foundries increased their melt up to 50 per cent within the last four months. Addition of night shifts and rounding out of day crews expanded labor forces at some foundries as much as 30 per cent. Tightening availability of labor has not hampered production expansion but plenty of difficulty is anticipated for the future. Foundry leaders here are urging immediate start of apprentice training programs and advocate foundry mechanization to cushion labor shortages. Mechanization, they say, will decrease the numbers of workers required and make it possible to use less skilled help. Interest in apprentice training lags and

(*Concluded on page* 165)

Maynard T. Murray, general manager of the Ford Aircraft Engine Division, Chicago, and Lt. Col. R. F. Murphy, USAF resident officer in charge, look at some of the 20,000 disassembled parts that make up a Pratt & Whitney R-4360 engine. Ford has contracted to build these big engines in Chicago



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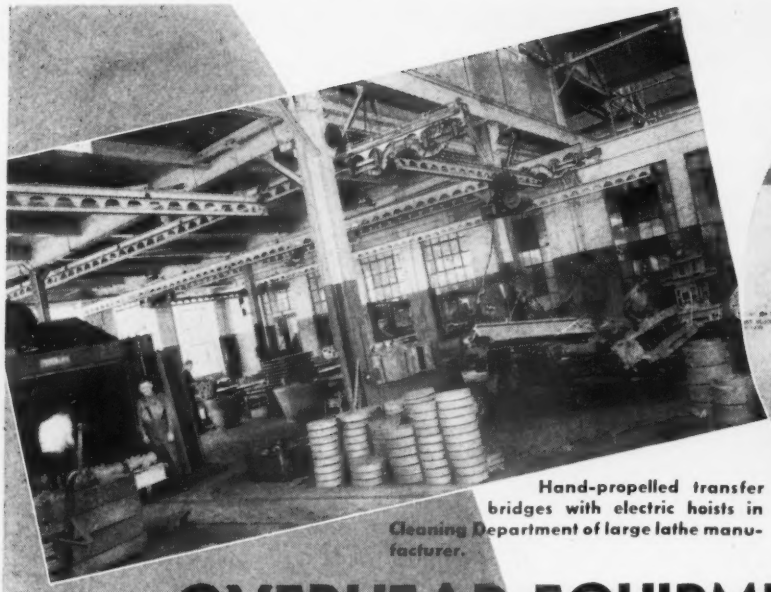
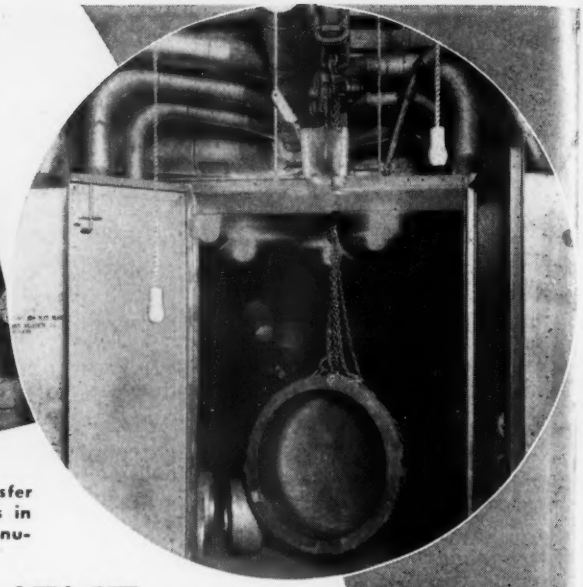
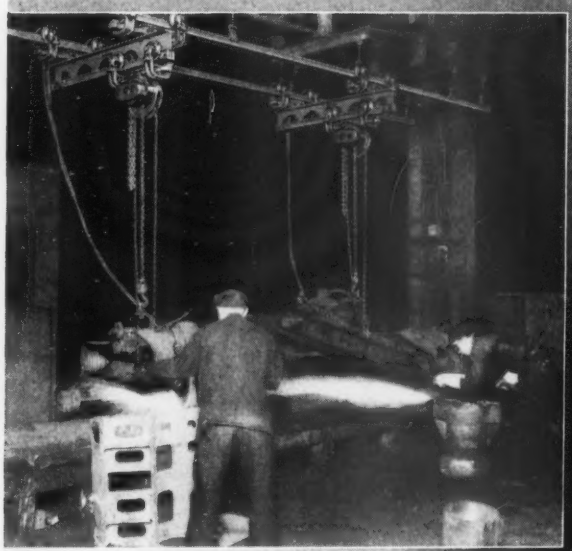


Hand-propelled transfer bridges with electric hoists in Cleaning Department of large lathe manufacturer.



Heavy castings are carried into chamber and supported on overhead tramrail during blast cleaning.

OVERHEAD EQUIPMENT *Operates Smoothly in* Abrasive Plants



Hundreds of short-span Cleveland Tramrail cranes are handling swing grinders in many plants.

In the cleaning departments where castings, forgings, billets, etc., are ground and blasted, will be found convincing proof of the design, workmanship and quality built into every piece of Cleveland Tramrail equipment. Here also is demonstrated the inherent correctness of locating materials handling facilities above and away from the floor where dust conditions are worst.

Despite blasting, piercing storms of grit, and atmospheres churning with penetrating abrasive dust, the equipment continues smooth and easy in operation — even after years of continuous service.

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THE CLEVELAND CRANE & ENGINEERING CO.
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CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT

(*Concluded from page* 162)

little is being done.

Flow of DO business is heavier and rising steadily. Spectacular, but not typical, is a 300 per cent increase since January of DO orders for a nonferrous foundry. Industry observers say local DO activity, currently ranging from 5-60 per cent of foundry order backlogs, lags that of eastern foundries. They point out that the vital oil, transportation, and agricultural equipment industries, users of a large part of the casting output of district foundries, are so far unrated. Additionally, foundrymen suspect the amount of defense contracts placed with West coast casting users is far smaller than in the East, even on a proportionate basis.

However, contracts to Food Machinery Corp., San Jose, for 850 T18 armed vehicles and the contract to Pacific Car & Foundry, Seattle, for 100 motorized gun carriers is felt in increased DO activity here.

All is quiet on the smog front. Fifty-one out of 60 gray iron foundries signed contracts to purchase permanent, high-efficiency smog control apparatus acceptable to the Los Angeles County Air Pollution Control District. The remaining foundries are expected to fall into line shortly.

* * *

DETROIT—To the extent that raw materials are available, this area's foundries are fully occupied. This means operation sustained at a five-day week with overtime being scheduled only where unusual circumstances permit a build-up in materials inventory.

Among the busiest shops at the moment are those specializing in automotive die work. It is understood that General Motors' body dies are now out of the foundries and in the tool shops. The thorough-going changes in Ford, Lincoln and Mercury dies, however, are still requiring high-level foundry operations. About another month is expected to be required before the die foundries complete their phase of the automakers' 1952 body programs.

New engines for several 1952 models are approaching the foundry level. Patterns for the new Ford six-cylinder engine are understood to be out. Other engine programs are reportedly well advanced and have progressed beyond the point where recall is a serious possibility. Much of the new machinery is undergoing finishing stages, and autobuilders are pressing builders to move this out before it seriously interferes with defense work.

New machinery for the shell molding process is under wraps at the moment, as is the progress being made by automotive foundries who are using or will use this process. It is understood, however, that automatic molding, induction heating and push-button core-blowing machinery to capitalize on the process is in being. Ford reputedly has the jump on the industry with its shell molding setup. Reportedly, valves are being cast on a production basis and crankshafts will soon follow. Significant changes in cupola practice, including use of hot blast, are also in prospect for automotive foundries.

Meetings of Interest to Foundrymen

Apr. 2-4—American Institute of Mining and Metallurgical Engineers, National Open Hearth Conference, Cleveland

Apr. 19-20—Malleable Founders' Society, Market Development-Mobilization Conference, Rensselaer Polytechnic Institute, Troy, N. Y.

Apr. 22-23—Non-Ferrous Founders' Society, annual meeting and industry dinner, Buffalo Athletic Club, Buffalo

Apr. 22-26—American Ceramic Society, annual meeting, Palmer House, Chicago

Apr. 23-26—American Foundrymen's Society, annual convention, Buffalo

Apr. 26—National Castings Council, annual meeting, Hotel Statler, Buffalo

Apr. 27—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Apr. 30-May 4—Material Handling Institute and American Material Handling Society, exposition and conference, International Amphitheatre, Chicago

May 4—American Association of Spectrographers, symposium, Society of Western Engineers Building, Chicago

May 18—Malleable Founders' Society, eastern sectional meeting, Hotel Commodore, New York

May 23-24—American Society for Quality Control, annual convention, Hotel Cleveland, Cleveland

May 25—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

June 4-6—French Foundry Association, foundry congress, Paris, France

June 12-15—Institute of British Foundrymen, foundry congress, Newcastle-on-Tyne, England

June 18-22—American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hotel, Atlantic City, N. J.

June 22-23—Malleable Founders' Society, annual meeting, the Homestead, Hot Springs, Va.

July 27—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Sept. 10-14—International Foundry Congress, Brussels, Belgium

Sept. 10-14—Instrument Society of America, conference and exhibit, Sam Houston Coliseum, Houston, Tex.

Sept. 24-25—Steel Founders' Society of America, fall meeting, The Homestead, Hot Springs, Va.

Oct. 15-19—American Society for Metals, annual meeting and exhibit, Michigan State Fair Grounds, Detroit

Oct. 19-20—Texas Regional Foundry Conference, Texas Chapter of the AFS, Shamrock Hotel, Houston, Tex.

Oct. 25-26—Gray Iron Founders' Society, annual meeting, Edgewater Beach Hotel, Chicago

Oct. 31-Nov. 2—Foundry Equipment Manufacturers' Association, annual meeting. The Homestead, Hot Springs, Va.

Nov. 7-9—Meehanite Casting Manufacturers, annual meeting, the New Yorker, New York

Nov. 7-9—National Foundry Association, annual meeting, Shoreham Hotel, Washington

Nov. 8-10—Steel Founders' Society of America, Technical and operating conference, Carter Hotel, Cleveland

Dec. 6-8—American Institute of Mining and Metallurgical Engineers, Electric Furnace Steel Conference, Hotel William Penn, Pittsburgh

1952

Feb. 21-22—Birmingham Regional Foundry Conference, Birmingham District Chapter and University of Alabama Student Chapter of the AFS, Tutwiler Hotel, Birmingham

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New Automatic Power Core Draw Machine shows over 300% Increase in Production in First Year's Trial Run

MODEL
SP-500

This special power rollover and automatic power core draw unit was developed and put into production about 12 months ago. Results were so successful that we are now offering it as a standard production unit in two sizes which will meet most foundry requirements.

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rollover and draw machines designed by Sutter, saved labor and increased core production.

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draw machines are interchangeable for right or left hand jacket cores, replaced single hand and hand draw operations. Result, production more flexible, reduced labor fatigue.

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PRODUCTION PROBLEMS AND BUILT MACHINES....

WHAT IT DOES and HOW IT WORKS

*This new Sutter unit is used at the end of a core blower with the core box indexing in and out as a single operation, or may be placed in a loop set-up allowing the core box to pass over and around to the blower operator.

Equipped with a double rollover frame, the operator is able to blow a core with a second box as the first box already blown moves to a bottom position where the core is drawn automatically without any attention from the operator.

Installed at a slightly higher level, the blower is so positioned that the operator can remove the core from the draw table in most cases without bending or stooping to complete the cycle.

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Operating on a six-second cycle from clamp of the core dryer to placing the core down on the draw table, this machine has increased production over other methods by 3 to 4 times. Workers like it because it definitely lessens fatigue. As one operator puts it, "My work is getting easier all the time!"

SPECIFICATIONS—

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SUCCESSFUL WISCONSIN CONFERENCE

Attracts Over 600 to Milwaukee, Feb. 8-9

By EDWIN BREMER, WILLIAM G. GUDE and ERLE F. ROSS
FOUNDRY

WISCONSIN Chapter, AFS, and the University of Wisconsin collaborated at Milwaukee, Feb. 8-9, for another in their long series of successful regional foundry conferences. This 14th annual meeting measured up in all respects to the quality of its predecessors, and attracted well over 600 foundrymen.

At the first general session, presided over by Chapter President Walter W. Edens, Badger Brass & Aluminum Foundry Co., the opening address was made by Dean M. O. Withey of the College of Engineering at the University. Activities of the national society were discussed by AFS President Walton L. Woody, National Malleable & Steel Castings Co., Cleveland.

Fifteen technical sessions plus two luncheon meetings and the annual banquet comprised the remainder of the program. Under the title "Is This Where We Came in?" the first luncheon talk by George K. Dreher, Foundry Educational Foundation, Cleveland, described the vast improvement in foundry technology, capacity and public acceptance of its products today compared with the situation when defense demands prevailed ten years ago.

Luncheon and Banquet Sessions

At the concluding day's luncheon, Austin Kiplinger, Chicago news commentator, declared it may be another year before the U. S. economy becomes as tight as the scare buyer thinks it is now. Much defense work, he said, will go into plants already experienced in such production and into plants merely idle since 1945.

Walter W. Edens presided at the annual banquet held Thursday night. Over 600 were in attendance. Speaker was Fred A. Hartley Jr., co-author of the Taft-Hartley law, who stated that the law did not abrogate any rights of the workers, but rather increased them. He also claimed that the law which bans jurisdictional strikes and substitutes machinery for settling such disputes, had saved millions of dollars.

A diversified discussion of cleaning room practice was offered at the opening Nonferrous session, presided over by Kenneth Jacobs, Standard Brass Works, and M. E. Nevins, Wisconsin Centrifugal Foundry. J. G. Bair, Fox Grinders Inc., Philadelphia, talked on swing frame grinders, listing maintenance troubles and how to overcome them. If the swing frame grinder is used as a cut-off wheel, the new type reinforced wheel should be used, he said. Similar recommendations on use and maintenance of portable tools were given by H. G. Jackson, Chicago Pneumatic Tool Co. B. H. Work, Carborundum Co., Niagara Falls, N. Y., suggested that personnel be informed of speed required for type of grinding wheel being used; that the proper abrasive be selected; that overloading be avoided; that adequate power be employed, and that work be held at the center of the wheel in grinding.

Mechanization of small jobbing foundries was discussed at the second Nonferrous session by L. G. Probst, National Engineering Co., Chicago. Meeting chairmen were D. S. Bosman, Bucyrus-Erie Co., and J. L. Kammermeyer, Federated Metals Division. Mr. Probst recommended that foundries considering mechanization be guided in their decision by the estimated increase in production indicated, reduction in labor costs, and value of improved working conditions that results. He suggested starting on a small scale, adding additional equipment from time to time, and paying for it through the savings resulting from its use.

Operation of the Reda furnace was described at the third Nonferrous session by J. G. Winget, Reda Pump Co., Bartlesville, Okla. This meeting had Lawrence Andres, Lawran Foundry Co., and John Bradisse, Specialty Brass Co., as chairmen. The Reda furnace, designed originally by the Reda Pump Co. for use in its own foundry and subsequently offered for sale for melting both ferrous and nonferrous metals, claims these advantages over conventional melting media: Greatly increased melting rate; greatly reduced maintenance and fuel costs; savings in labor; high physical properties of metal melted; less metal losses; improved working conditions; low initial cost, and saving in floor space.

James O'Keeffe Jr., Exomet Inc., Conneaut, O., told the concluding Nonferrous session how to increase riser efficiency. The methods are: Use a minimum surface area per volume, preferably a round cylinder, for the risers; use chills to speed solidification; insulate the riser top; use insulating sleeves and top insulation, thereby giving 50 per cent riser efficiency and 75-85 per cent yield on castings; add heat to the riser, such as by the thermit process. Casimir Kotowicz, Ampco Metals Inc., and Carl Van Buren, Allis-Chalmers Mfg. Co., were meeting chairmen.

Recommendations for grinding wheel use in the malleable iron foundry were offered at the first of four Malleable Iron sessions by A. S. Rakestraw, manager, engineering department, Chicago district, Norton Co. Mr. Rakestraw discussed effect of grinding wheel pressure, speed and grain hardness on costs. In describing wheel use, he pointed out that the resinoid type wheel is not economical when used at speeds below 7500 surface feet per minute. P. H. Carlson, Norton Co., was meeting chairman.

Bake Cores Electrically

Second Malleable session heard J. Robert Roe and John Dawson, Allis-Chalmers Mfg. Co., Milwaukee, describe and discuss "Dielectric Core Baking." Norman Amrhein, personnel manager, Federal Malleable Co., West Allis, Wis., was chairman, and P. J. Anderson, International Harvester Co., Milwaukee, was co-chairman. Concerning himself with the operational aspects of this form of core baking, Mr. Roe emphasized the importance of selecting the resin binder which will provide the characteristics required in the cores. A dielectric machine with 40 kw output will require 80 kw input, including blower and belt drive, according to the speaker, and with power at 1 cent per kilowatt-hour baking cost per ton of cores would be about $1.10. Mr. Dawson's contribution was confined to the electronic aspects of dielectric baking.

"Do You Believe Your Molding Sand Can Affect Your Casting Shrinkage?" was the intriguing question which Clyde A. Sanders, vice president, American Colloid Co., Chicago, posed to the third Malleable session, then proceeded to answer. The chairman was Martin Harder, general superintendent, Lakeside Malleable Casting Co., Racine, Wis., and H. C. Stone, metallurgist, Belle City Malleable Iron Co., Racine, was co-chairman. The speaker described a painstaking investigation which

(*Please turn to page* 242)

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5. Positive operator control on throttle, brake, clutch

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8. Engine and fuel tank on top rear of chassis

How to use the CUPOLA

By BERNARD P. MULCAHY
President
Fuel Research Laboratory Inc.
Indianapolis

Suggestions for the selection and stocking of cupola scrap and pig iron are offered in this fourth of a series of articles

MANY of the metal losses, difficulties and high operating costs in using the cupola can be attributed to or associated with the scrap used.

It is recognized at the outset that well sorted and classified scrap has been difficult if not impossible to obtain the last few years; in fact, No. 1 machinery cast exists in name only. Of necessity this places a heavier burden on the plant in segregating the undesirable material received.

In discussing this problem it is first necessary to identify the materials which are generally unsuitable for good melting practice. These consist of:

Burned Iron—Including burned grate bars, fire bowls, annealing boxes, etc. This material is undesirable because it contains excessive amounts of highly oxidized iron, Fe_3O_4, which cannot properly be reduced in the cupola. This material will invariably cause hard spots in the castings.

Hard or Chilled Iron—This will consist of car wheels, grinding plates, bells, etc. This iron is white, is low in silicon and possibly contains elements used for inducing chill sections. Such iron will carry through and produce chilled or hard iron in the metal poured. The elimination of this iron refers, of course, to regular gray iron production.

Nonferrous—A common form of undesirable material in this class is aluminum in the form of oil pans and pistons in automobile blocks. This metal in not too large quantities will cause excessive porosity in the castings poured. Bearing metal, brass and zinc, also should be removed.

Stove Plate—This is mentioned because of its high phosphorous content which may be injurious to certain castings—highly sensitive to this material—producing excessive shrinkage cracks.

The first three items should be eliminated completely from all metal charged where the factors mentioned are important.

Cast scrap should be purchased from dealers who will reliably deliver the type of scrap ordered. Unsorted scrap, for example, can be a source of many headaches due to the variable content of steel and other extraneous materials.

Motor blocks by themselves are excellent scrap, but unstripped complete blocks frequently are far too large to charge except in the largest cupola, yet it is not unusual to see such material being charged intact in 48-in. cupolas, because the shop itself cannot strip them.

Extra heavy or thick sections are another source of difficulty, particularly in small cupolas where the time is too short to melt them properly.

In many instances it is not necessary to pay a premium price for steel rails cut to specified lengths, because other good material may be available locally. Here again, however, care must be exercised in its selection. Thin croppings, for example, are completely undesirable for cupola melting because of the rapidity of oxidation.

Plate scrap may be a source of considerable difficulty where the material is of such size and character as to permit "fish-scaling" or leafing. Such material will give poor permeability of the stock and cause channeling of the gases.

In all instances, badly rusted material should be avoided. Baled wire or thin scrap also is undesirable. Borings of either steel or iron must be used carefully, if at all.

Briquetting helps the use of borings to a certain extent, but their value in many instances is questionable. Briquetting not done properly results in considerable degradation in handling, particularly with a magnet. The fines produced accumulate and are picked up by the magnet. These fines, when charged into the cupola, represent a metal loss by being blown out of the stack and, additionally in melting, suffer a very high loss of oxidation. This is also true of the briquets themselves. This is clearly reflected in the high losses of silicon, manganese and carbon usually encountered.

Badly rusted material requires heavier fluxing with consequent higher refractory costs and, of course, metal losses from melting are increased. These facts should be weighed against the lower initial cost to determine the justification of their purchase.

It is not possible, of course, to obtain prime scrap at all times, but care should be exercised that there is a reasonable balance between the inferior materials and the better grades so that the cupola is not forced to assimilate indigestible metals.

Returns—Although it is recognized that each shop will use all of its own returns as a matter of economy, several factors should be considered for best performance.

In too many instances the condition of the returns is disregarded because they are all considered as consisting of average composition. Chemically this is true, but their physical state and availability may introduce some serious problems.

Shop clean-up may consist of shot and spillage recovered from the sand. Usually this is accumulated and frequently is used as it is received at the charging floor. This material may contain excessive sand, and in this condition it can cause or start a bad "bridge." To correct this, such material should be distributed through

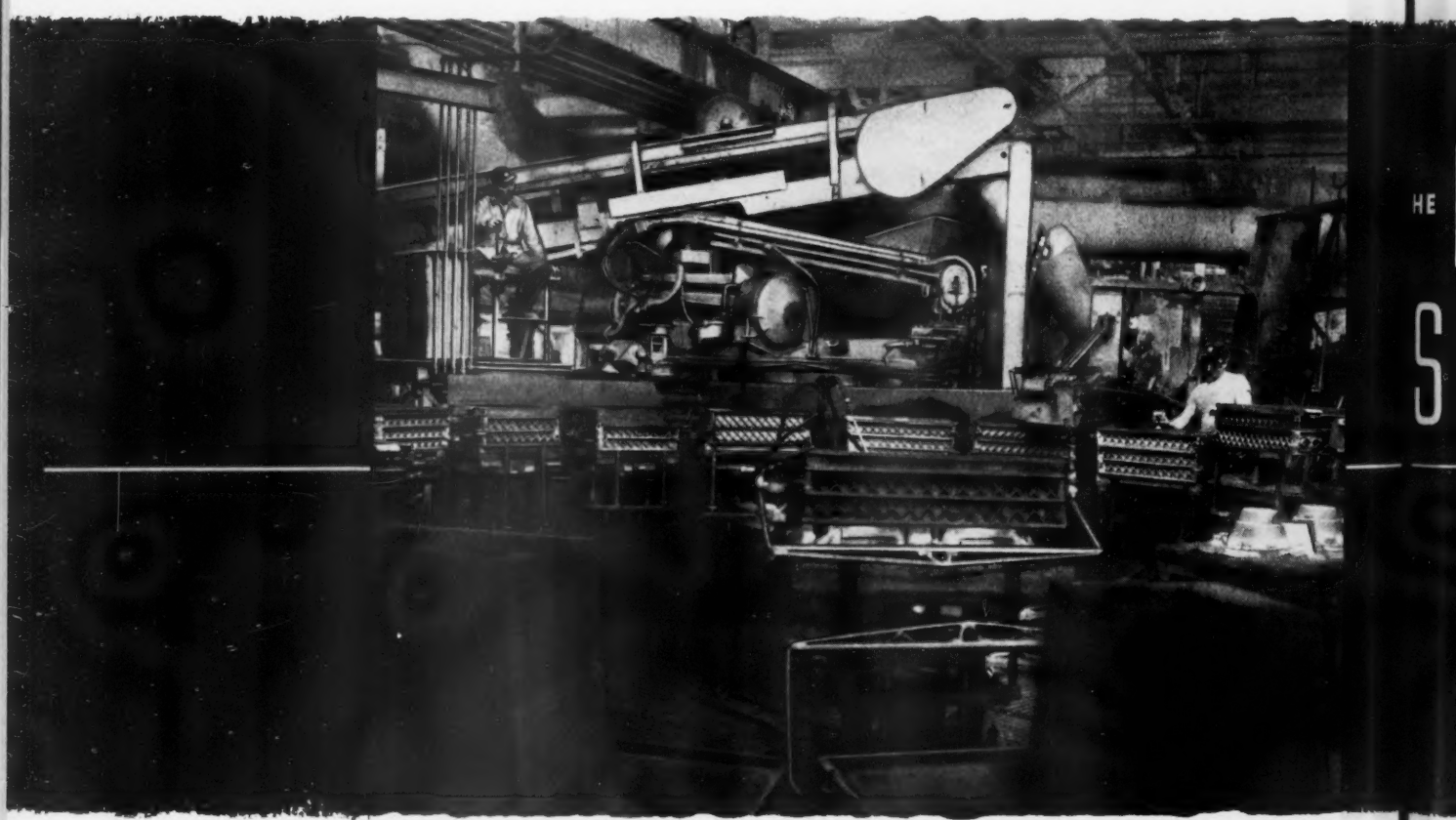
(*Concluded on page* 174)

TODAY'S ANSWER . . . TO YOUR

Maximum flexibility for ramming a variety of patterns on short-run or high-production work . . . adaptable to the jobbing or production foundry, whether gray iron, steel, malleable iron or non-ferrous . . . pattern changes made with no interruption to molding . . . operator fatigue eliminated, permitting top efficiency throughout the shift . . . truer-to-pattern molds and higher quality truer-to-dimension castings . . . these are the reasons a Hydra-Slinger unit is today's answer to your foundry's mold production problems.

Belle City Malleable Iron Company, Racine, Wisconsin, finds their Hydra-Slinger unit extremely effective for ramming short-run or production work. Pattern changes are made without interruption to operations and mold hardness may be varied to suit the job. All molding operations at the 16 molding stations are carried on by only 8 men, including the Slinger operator. Eight different jobs are rammed simultaneously and flasks range in size from 17″ x 20″ to 22″ x 53″. A rate of production of 80 to 100 complete molds per hour has been attained on these molds, many of which are heavily cored.

A Hydra-Slinger, Sandslinger, or Speedslinger will solve your toughest molding problem. Write now! A complete catalog on all Slinger models is available on request.



The molding turntable moves continuously during all molding operations including Hydra-Slinger ramming. Completed molds are closed on a power conveyor which circles concentrically around the turntable and carries the molds to pouring, cooling, and shakeout stations.

CODUCTION OR SHORT-RUN MOLDING PROBLEMS

The Hydra-Slinger, rated at 12 to 15 cu. ft. of sand per minute, easily rams over 23 cu. ft. (1760 lbs.) per minute at Belle City Malleable. Ease of operation and excellent visibility are available to the Hydra-Slinger operator from a remote control station. The Hydra-Slinger's remote controls may be placed at any location adjacent or above the ramming area for maximum efficiency of control.

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Today's answer is the portable MULBARO

Here's how to have mulled sand readily available in *any* location in the foundry. Use a Mulbaro . . *today's answer* to small foundries for *all* their mulling . . . to large foundries for mulling special batches of facing and core sand and for mixing ladle lining and cupola patching material.

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(*Concluded from page* 171)

the charges and not charged all at once.

If some of the returns are small, they should not be charged altogether but also distributed throughout the charges. Sometimes these are used as soon as available from the shop, but they should be accumulated and distributed.

Excessive sand on the sprue can cause a bad slag condition in the cupola. It adds to the volume of slag handled and also can adversely change the composition of the slag to the point where "bridging" is encouraged.

Pig Iron—In recent years with the recurring shortage of pig iron the question is repeatedly asked in connection with regular gray iron "What is the minimum amount of pig iron we can use and retain a high quality iron"? Obviously, this must vary with different conditions, but there appears to be an irreducible amount—is in the neighborhood of 20 to 25 per cent. It is possible, of course, to go below this minimum for a short period, but to do so for a protracted period will eventually cause poor iron.

Type of scrap and returns used, as well as cupola conditions, will materially affect the quantity of pig iron required because the overall state of oxidation will govern the condition of the metal.

Stocking—After a policy has been established with respect to the materials to be used it will be necessary to provide some means for receiving and storing them so that they may be recovered and used in regular amounts.

To charge regular quantities of the materials available it is evident that they must be accessible at all times, whether by crane and magnet or by hand. This means separate piles or bins.

Proper stocking of materials is absolutely essential to good mixing or chemical balancing. This must include, of course, the shop returns also. Frequently many shops disregard regular distribution of returns and use them as they become available on a very uncertain time schedule.

All classes of materials should be stocked separately. This will include: Returns, purchased cast scrap, steel, borings, each grade of pig iron.

It is necessary also, if different grades of the various materials are used, to separate them so that they can be evenly distributed.

Hand handling of all this material is costly and at times dangerous; for this reason magnet handling is preferred if the tonnage poured can justify this expense.

(*To be continued next month*)

Aluminum Association Elects Officers

At its annual meeting Jan. 23-25 in New York, the Aluminum Association elected A. P. Cochran, Cochran Foil Co., Louisville, president for the ensuing year. Vice presidents are: I. T. Bennett, Revere Copper & Brass Inc., Baltimore; L. M. Brile, Fairmont Aluminum Co., Fairmont, W. Va., and E. G. Fahlman, the Permold Co., Medina, O. A. V. Davis, Aluminum Co. of America, New York, was re-elected chairman of the board, and Donald M. White was reappointed secretary-treasurer.

Three directors-at-large were elected to serve three-year terms: G. A. Ginsburg, United Smelting & Aluminum Co., New Haven, Conn.; R. S. Reynolds Jr., Reynolds Metals Co., Richmond, Va., and Harry L. Smith Jr., Aluminum Co. of America, Pittsburgh.

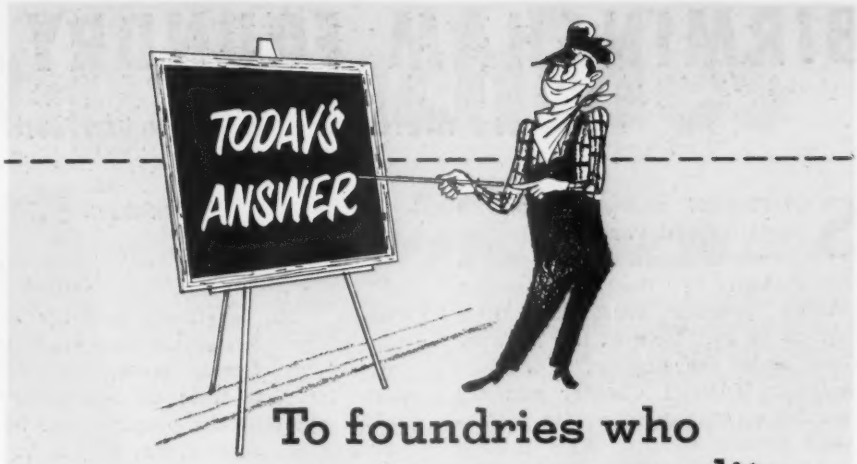
Various divisions of the association also held sessions during the meeting. J. P. Watry, Aluminum Casting & Engineering Co., Milwaukee, was elected chairman of the foundry division and R. J. Roshirt, Bohn Aluminum & Brass Corp., Detroit, was named vice chairman. H. J. Hater, Aluminum Industries Inc., Cincinnati, was appointed the division's representative on the board of directors.

Book Review

ASTM Methods of Chemical Analysis of Metals 1950, cloth, 476 pages, 6 x 9 inches, published by American Society for Testing Materials, Philadelphia 3. Price $6.50.

This new book, replacing the 1946 edition, is greatly expanded, and is the culmination of intensive work by ASTM Committee E-3 on Chemical Analysis of Metals and the headquarters staff. It provides in their latest re-edited form all of the previous methods and is supplemented by many new testing procedures. The book contains 39 extensive standards and is the only one in which they appear together in convenient form. Newer methods take advantage of shorter procedures which have been developed, and also cover additional metals. Several spectrochemical methods prepared by Committee E-2 on Emission Spectroscopy are included.

Metals and alloys covered in the book include ferrous metals and alloys, ferroalloys, nickel-chromium-iron alloys, nickel and nickel-copper alloys, copper and copper-base alloys, aluminum and aluminum-base alloys, magnesium and magnesium-base alloys, lead tin antimony and their alloys, silver solders, zinc and zinc-base alloys.



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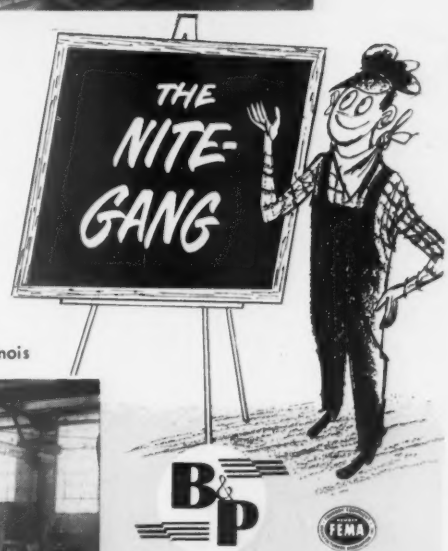

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BIRMINGHAM FOUNDRY CONFERENCE

Covers Metallurgical, Production Problems

By FRANK G. STEINEBACH
Editor
FOUNDRY

SOUTHERN interest in foundry metallurgical and production problems again was shown at Birmingham at the 19th annual foundry practice conference there Feb. 22 to 24. Held at the Tutwiler Hotel under the auspices of the Birmingham District Chapter and the recently organized University of Alabama Student Chapter, AFS, it drew an attendance of 425.

The technical program was officially opened Thursday morning with R. L. Jackson, executive vice president, Jackson Industries, presiding. Tom E. Eagan, chief metallurgist, Cooper-Bessemer Corp., Grove City, Pa., gave a challenging talk on "Engineering Properties of Gray Iron for Foundrymen." While gray iron production far exceeds the combined output of all other types of castings, Mr. Eagan believes it is possible that foundrymen still do not know the potentials of gray iron. Progress has been great, but the importance of this metal can be increased considerably if the properties of gray iron are understood and applied properly.

Properties of gray iron are controlled by the size, amount and distribution of graphite. In this connection, Mr. Eagan showed the ASTM-AFS graphite chart and discussed the various types of structures. Because engineers must have some way of designating the various types of gray iron, the ASTM has developed specifications covering a range of classes. But engineers are beginning to question specifications based entirely on tensile strength. Because test bar tests do not necessarily represent the properties to be found in the casting, but only measure the properties of the metal poured into the casting, methods are needed to correlate the properties in the test bar with those in the casting.

Cutting up a casting and comparing with the ASTM arbitration bar is the best way to determine the relationship. Mr. Eagan's company has developed a method which includes comparison of a chart showing tensile strength in the casting plotted against tensile strength in the test bar, and a chart showing carbon equivalents. In his opinion, ways must be found to produce properties in the casting comparable with those in the bar.

Mr. Eagan then discussed various properties of gray iron, and indicated their importance. He stated that while gray iron does not have a true modulus of elasticity, there are many cases where it does a job, due to this reason—for example, in the case of gray iron crankshafts for large engines.

In conclusion, he stated that no designer wishes to design a casting that cannot be made satisfactorily. At the same time, many foundrymen take too much pride in the belief they can cast any shape, and therefore do not go to the customer with suggestions for simplification which would improve castability. Consequently, the foundryman accepting such business may lose his shirt. To date, the designer does not have enough information on what can be made. For that reason, the foundryman and designer must get together to educate each other on where gray iron can be and should be used.

Cooper Green, mayor of Birmingham, welcomed the foundrymen to the city, at the luncheon on Thursday. The mayor prefaced his remarks with a little bragging over the fact that at one time he worked in a foundry or two in Birmingham, but he emphasized the fact that he was not a boss—just a worker. The mayor made such a good talk that many of those present rather wished he had remained in the industry and worked his way up as he has in politics.

William W. Maloney, secretary and treasurer of the AFS, complimented the mayor on the excellence of his talk, and then introduced Walton L. Woody, vice president in charge of operation, National Malleable & Steel Casting Co., Cleveland, and president of AFS. President Woody brought Birmingham foundrymen up to date on AFS with a fine review of the various society activities. Educational activities include publications, chapter work, the annual meeting, the biennial exhibit of foundry equipment and supplies, nine regional conferences, and research in each metal classification. In the field of promoting foundry education, President Woody referred to the work with trade schools, and the help being given engineering students through the Foundry Educational Foundation. Original research is being conducted at nine institutions. The president also spoke of the organization of a safety and hygiene program, and the campaign for $100,000 to provide an AFS home. He stated that $85,000 had been pledged, but that rising costs probably will increase the total amount needed. Charles K. Donoho, American Cast Iron Pipe Co., presided at the luncheon.

(*Continued on page* 178)

National and local officers at the conference were, left to right: Walton L. Woody, National Malleable & Steel Castings Co., Cleveland, and national AFS president; Fred K. Brown, Adams, Rowe & Norman Inc., Birmingham, chapter secretary-treasurer; William W. Maloney, national AFS secretary; Morris L. Hawkins, Stockham Valves & Fittings, Birmingham, chapter chairman, and C. K. Donoho, American Cast Iron Pipe Co., Birmingham, chapter vice chairman

Molding Machines

New Bulletin describes SPO line of Jolt Pin Lifters

Complete data on the Series 3000 high-production jolt pin lifters are presented in this new illustrated catalog which is available to foundry management and purchasing personnel such as superintendents, foremen, production expediters, etc. Designed for maximum speed, safety and ease of operation, these machines feature the patented SPO "inverted jolt" mechanism.

The jolt pin lifters described in this publication have jolt capacities ranging from 750 to 4000 pounds and are fully adjustable to meet diversified production demands. Pivot type adjustable lifting pins will accommodate any type or size of flask within their capacities. Both breakaway and secondary draw speeds can be adjusted to different job requirements, and jolt impact intensity of each machine is variable.

In this catalog, dimensions, capacities, pattern draw, SPO vibrator size and other pertinent data are tabulated for quick reference. Photographs and line drawings depict the construction and features of the various machines.

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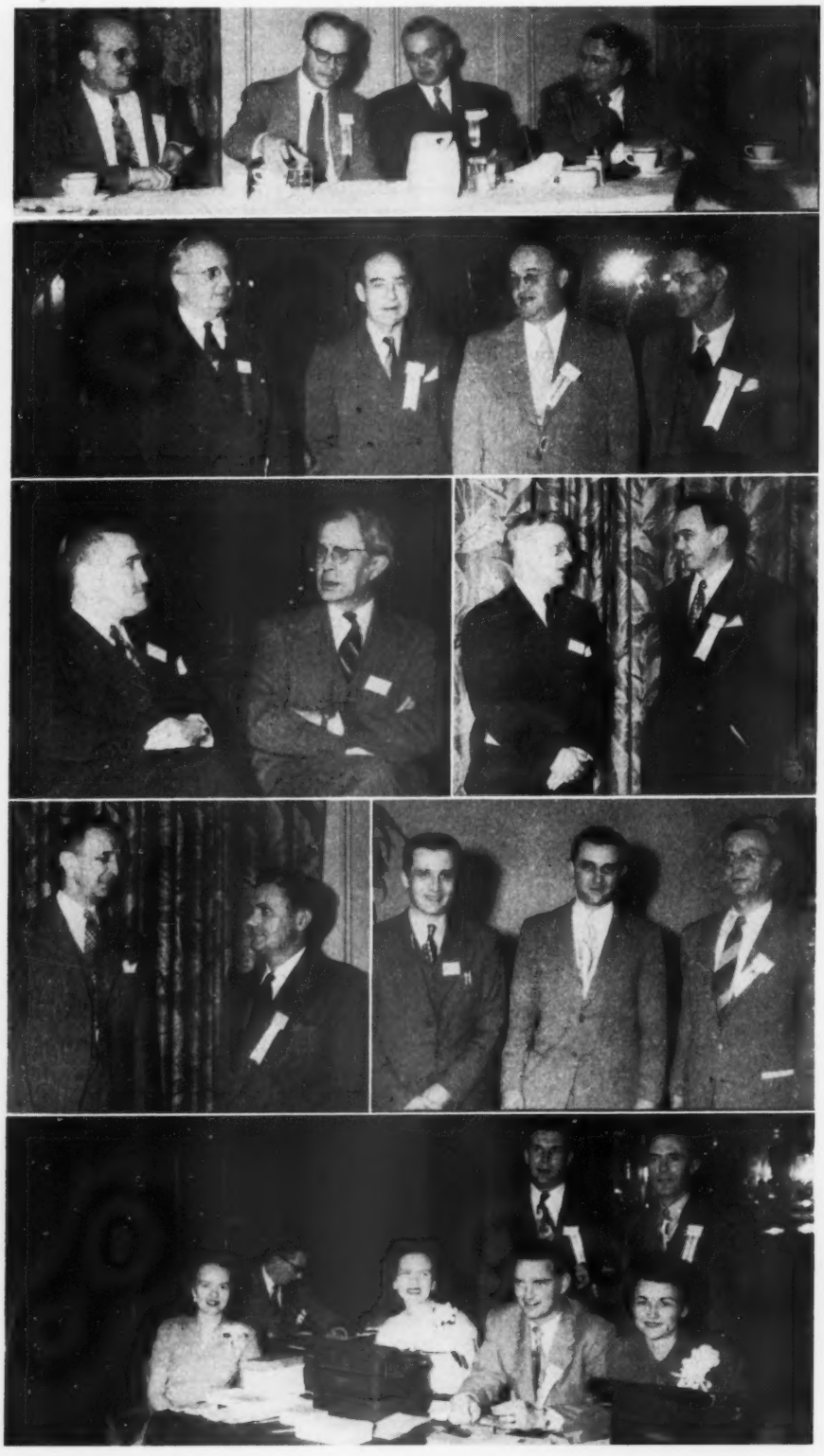
(*Continued from page* 176)

In the afternoon, L. A. Danse, Production Engineering Section, General Motors Corp., Detroit, presented an interesting talk, "Foundry Developments as G. M. Sees Them." Frank C. Coupland, assistant works manager, American Cast Iron Pipe Co., Birmingham, presided. Mr. Danse first explained the setup of the Production Engineering Section, which is charged with gathering, sifting and distributing information. He indicated that the section works not only with the various divisions of General Motors, but also with Ford and Chrysler, and on occasion with all automobile manufacturers.

Mr. Danse stressed the point that the automobile industry, with its high production lines, cannot stand down-time. Therefore, it is necessary to keep material rolling. An important work of the section has been the preparation of specifications covering electrical, hydraulic and pneumatic equipment. Material shortages including alloys, are the greatest problem of the automobile industry today, and Mr. Danse believes this situation will get worse.

The foundry committee of the Production Engineering Section has been concerned with the question "Why not pushbutton control for the production of castings?" Mr. Danse referred to the work of W. G. Reichert Engineering Co., Buick Motor Division, International Molding Machine Co., American Seating Co., Giffels & Vallet Inc. and others in developing certain types of pushbutton control equipment. The problem of producing cylinder blocks with pushbutton control is quite complicated, especially since the trend is away from the straight line block to the V8 block. But Mr. Danse believes that before long GM will be using almost automatic equipment for many simple castings, if not for the V8 block castings.



Additional views of the Birmingham foundry conference are shown above

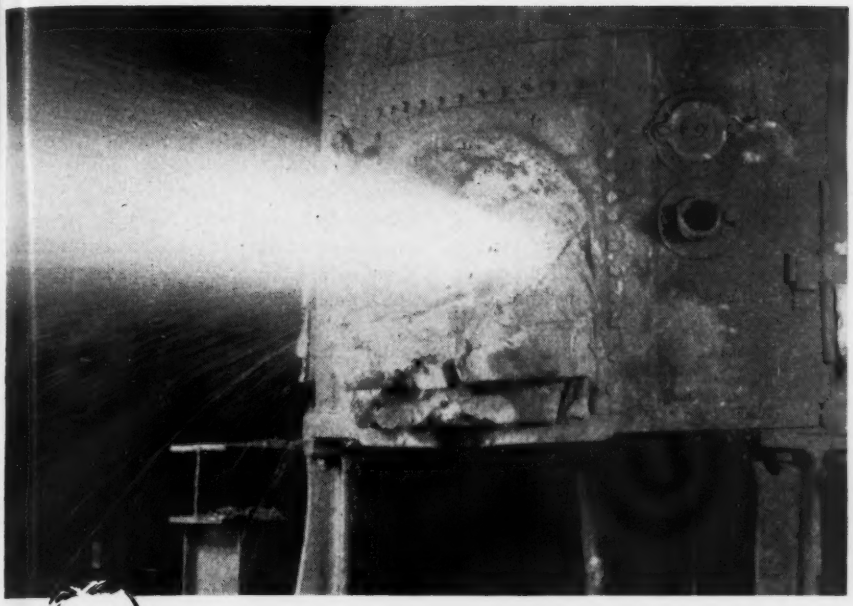
Use Zircon Sand

Mr. Danse also described some of the conversion work being done at Fabricast, the corporation's foundry at Bedford, Ind., which he described as the smallest but perhaps the fastest growing foundry of the organization. This plant has been producing the Dynaflow rotor casting in aluminum, but government restrictions on the metal have necessitated the use of substitutes. Through the work of the Research Laboratory Division under A. L. Boegehold these castings are being produced with a low alloy gray iron in a new molding material which uses zircon sand instead of plaster. Mr. Danse indicated that his organization would continue to take ideas "born 30 years too soon" and try to develop these in pilot plants. He prophesied that the foundry industry would see a lot of the push button type of production in the future.

The AFS sound film, "Fluid Flow in Transparent Molds," developed as part of the research project of the Aluminum Division, was shown at the second afternoon session.

Ralph L. Lee, General Motors Corp., Detroit, and FOUNDRY columnist, inspired an audience of well over 400 at the annual dinner Thursday evening with an address "Man to Man on the Job—A Matter of Feeling in Business." Morris Hawkins, Stockham Valves & Fittings Inc., and chairman of the Birmingham

(*Continued on page* 180)



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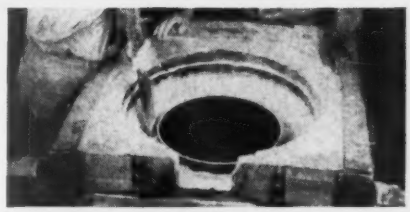

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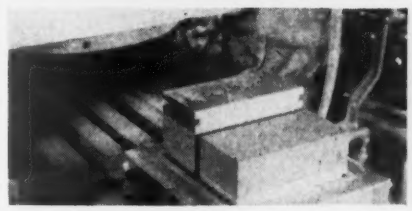

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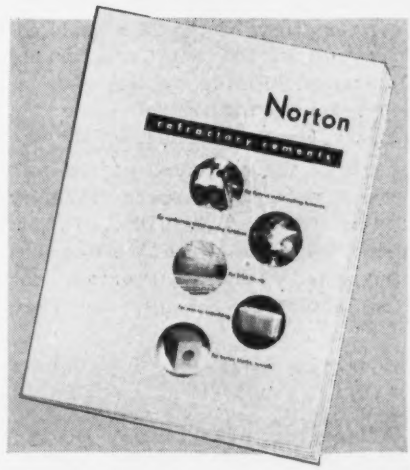

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(*Continued from page* 178)
Chapter, presided, and Richard J. Stockham, vice president, Stockham company, was toastmaster.

In his travels about the country visiting foundries, Mr. Lee finds plants that are somewhat equal in plant, equipment, and raw materials used, but are far from equal in quality of product or success of the enterprise. In his opinion, "People make this difference." It is something that the visitor can feel when he goes through the door of the company office. And it is the *feeling* of the organization, the feeling of each individual member, that makes the difference. Mr. Lee stressed the fact that most of the things people do are done because they feel like doing them, not because they think they are best. Somewhere between the little that people do because they can't get out of doing it and what they could do if they felt like doing it lies the margin which explains why some organizations, with everything else being equal, can, and do lick the pants off other organizations.

The first session Friday afternoon was devoted to a paper "Studies on Improvement of the Machinability of High Phosphorus Gray Iron," by Dr. W. W. Austin, Southern Research Institute, Birmingham. M. D. Neptune, metallurgist, National Cast Iron Pipe Co., Birmingham, presided. Dr. Austin explained that the complete paper on the subject will be presented at the Buffalo meeting of the AFS and that this discussion covered only the high points of the investigation and its results. Reference first was made to the preliminary laboratory study on the subject, reported in an AFS paper in 1948. This work indicated that the machinability of high phosphorus irons could be improved by proper desulphurizing and treating with 1 per cent of 13 per cent zirconium ferrosilicon alloy. The original project has been expanded to include foundry scale studies and these are reported in the paper.

Dr. Austin offered several definitions of the term "machinability" and indicated that it has a wide variety of meanings. Tests of machinability are of two classes, namely long-time tests dealing with tool life and short-

(*Please turn to page* 232)

FEF ADVISORY COMMITTEES HOLD CONFERENCE

AN intensive two-day discussion of subjects relating to engineering education as they apply to the foundry industry was conducted by the Foundry Educational Foundation at Cleveland, Feb. 15-16. The occasion was the annual conference of the foundation's University Advisory Committee and Technical Advisory Committee.

George K. Dreher, executive director, presided at the conference. In addition to members of the two committees, participants included other representatives of the 13 schools cooperating in the FEF program of foundry engineering training, plus invited representatives of some ten other engineering colleges.

Among the principal papers presented were: "Advanced Foundry Course Outline," by Prof. R. W. Heine, University of Wisconsin; "Suggested Lecture Program for Non-Laboratory Schools," by Prof. C. F. Walton, Case Institute of Technology; "Casting Design for Economical Production in an Engineering Curriculum," by Prof. C. T. Marek, Purdue University; "Foundry Educational Program as Related to Industrial Engineering Courses," by Prof. D. C. Williams, Ohio State University; "Foundry Educational Program as Related to Mechanical Engineering Courses," by Prof. L. C. Price and Prof. C. C. Sigerfoos, Michigan State College; "Foundry Educational Program as Related to Metallurgical Engineering Courses," by Prof. P. E. Kyle, Cornell University; "Role of Graduate Study in the Foundry Industry," by Prof. Howard F. Taylor, Massachusetts Institute of Technology; "Integrating Safety into Foundry Lecture-Laboratory Work," by L. M. Merritt and Prof. D. C. Williams, Ohio State University.

Speaker at a dinner meeting the first day was Dr. J. Elliott Janney, Cleveland management consultant on the subject "The Personality of the Business Team."

Technical developments in the individual branches of the FEF founding members were described at the second day's session. These were presented by C. O. Burgess, Gray Iron Founders' Society; James [illegible]sing, Malleable Founders' Society; C. W. Briggs, Steel Founders' Society of America, and A. J. Grindle, recently of the Whiting Corp., speaking for the Foundry Equipment Manufacturers Association. Herbert F. Scobie spoke on various educational and technical activities of the American Foundrymen's Society.

Claude B. Schneible, Claude B. Schneible Co., Detroit, and president of the FEF, discussed plans for increasing the effectiveness of the advisory committees which function for each of the engineering schools in the foundation's program.

Participants in the annual conference of advisory committees to the Foundry Educational Foundation

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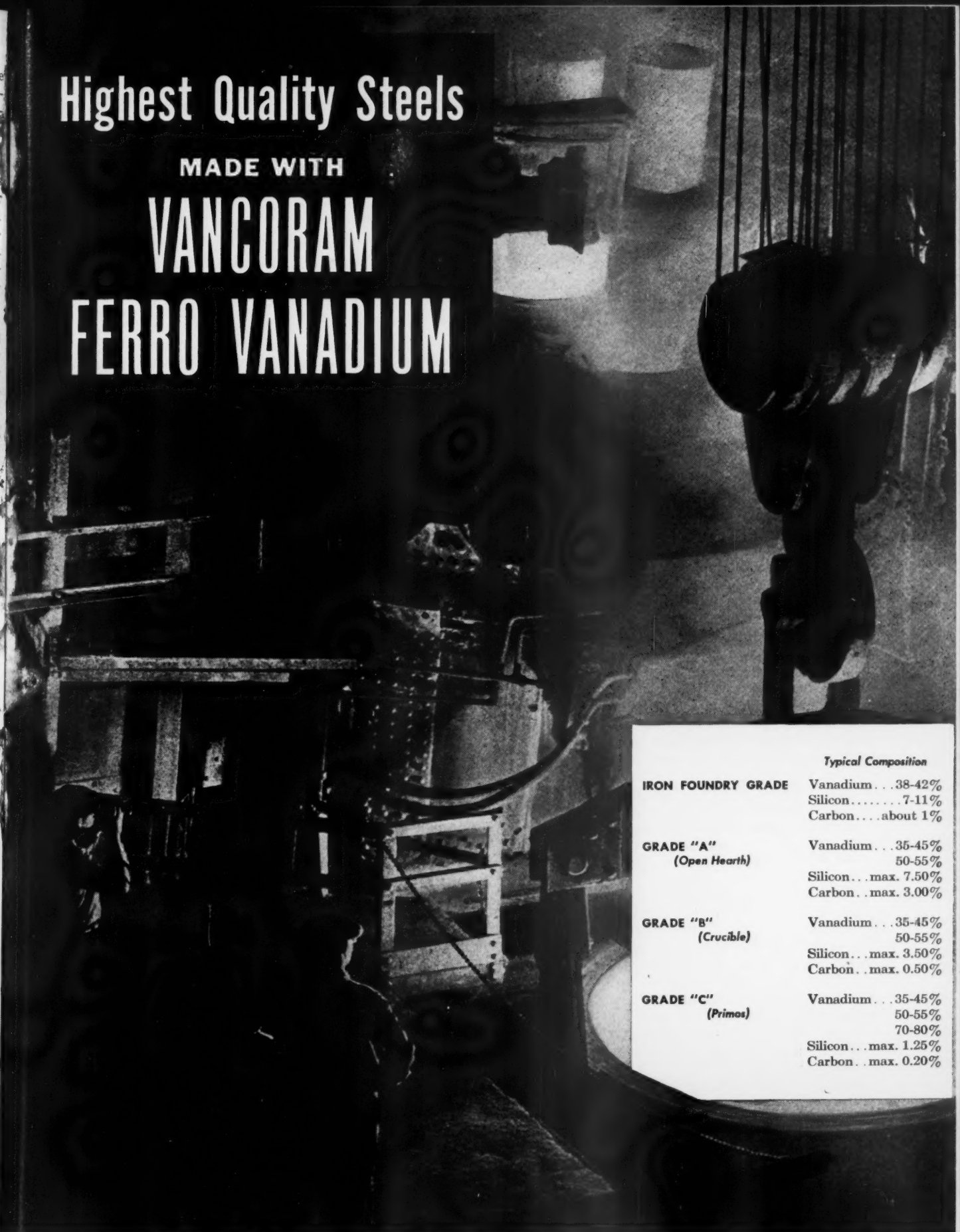

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CHEMICALS AND METALS

By EDWIN BREMER

Foundry DEVELOPMENTS

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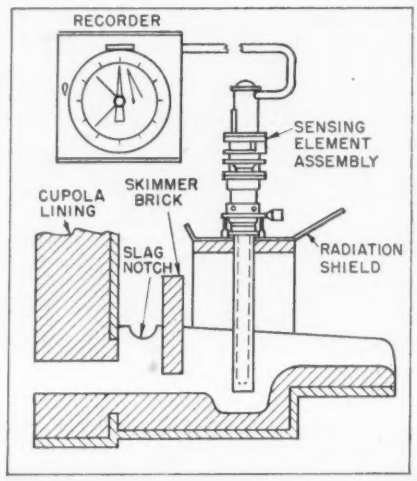
* * *

STEEL castings can be made radiographically sound without recourse to padding or chills, providing the distance from the perimeter of the riser to the edge of the plate is not over four and one-half times the casting thickness. This information, based on studies of steels containing 0.20 to 0.35 per cent C, and cast as plates with a width-to-thickness ratio of at least 3 to 1, is contained in a report available from the Office of Technical Services, Department of Commerce, Washington 25. The report was prepared by the Naval Research Laboratory and is part of a continuing study of basic foundry methods. In the current study relationships between thermal gradients and casting soundness were investigated by temperature measurements.

Report indicates that three thermal zones develop during solidification of plate castings—one adjacent to the riser, one at casting edges and an intermediate zone between the two. Sound castings result when the intermediate zone is eliminated or reduced to a width less than the casting thickness. Use of risers with diameters three times casting thickness is satisfactory. Extra large risers do not have any measurable effect on feed. Report is PB 101 392 "Contribution of Riser and Chill-edge Effects to the Soundness of Cast Steel Plates," and available from Office of Technical Services for 75 cents.

* * *

METHOD for obtaining a continuous record of molten iron temperature at the cupola is shown in the accompanying sketch. Designed for use with the front slagging spout, it includes a sensing unit and recorder made by Brown Instrument Division, Minneapolis-Honeywell Regulator Co., Philadelphia. Sensing element includes a lens to focus the radiant energy from the target tube immersed in the molten iron on a thermopile. Target tube consists of an outer clay graphite tube fitted over a gas-tight inner sillimanite tube to prevent fogging of the lens, and the whole assembly is equipped with an air-cooled fitting. The target tube is located directly after the slagging dam or brick, and the channel should be at least 10 in. deep to permit a minimum 9-in. immersion. Target tube is suspended through a refractory arch built over the spout, and to protect the sensing section of the tube from heat of slag and molten iron a radiation shield, as indicated in the sketch, should be provided.



* * *

RADIOACTIVE isotopes are being used effectively in tracers in a wide variety of studies to broaden knowledge about steel, according to the American Iron and Steel Institute. They are being used in studies of the physical chemistry of steelmaking, in studies concerning the distribution of carbon in steel, in studies pertaining to friction, and in studies about the diffusion of elements. Radio carbon 14 is being used to determine the distribution of carbon in steel, its segregation habits and the mechanism by which it causes steel to harden. Radioisotopes also enable the thickness of pipe walls to be determined by an instrument while the pipe is in service.

* * *

MUCH open-hearth slag formerly dumped on waste land in the vicinity of steel plants now is being prepared for use as part of the flux burden of blast furnaces, according to the American Iron and Steel Institute. Use of the slag not only decreases the amount of limestone used but also recovers valuable amounts of iron and manganese. However, use of the slag is limited due to its phosphorus content; it replaces approximately 10 per cent of the flux burden. Slag emerging from the blast furnace contains only about 0.5 per cent iron and a little less than 2 per cent manganese. Since basic open-hearth slags average 12 per cent iron and 6 per cent manganese, its use in the blast furnace recovers appreciable amounts of those elements.

* * *

RECENT article on "Experimental Work on Oil-Sand Practice" by D. T. Kershaw in the Feb. 1 issue of *Foundry Trade Journal* mentions use of ammonium nitrate in the mixture to decrease moisture loss due to evaporation when standing. It was found that the addition of about 1 per cent to the sand mix resulted in a considerable increase in strength and a noticeable decrease in time required to reach maximum strength. These phenomena are attributed to the dissociation of ammonium nitrate at the baking temperature which produces oxygen between the sand grains and speeds up oxidation of the core oil. To those experimenters who want to give it a trial, it should be pointed out that ammonium nitrate is an oxidizing agent used in explosives.

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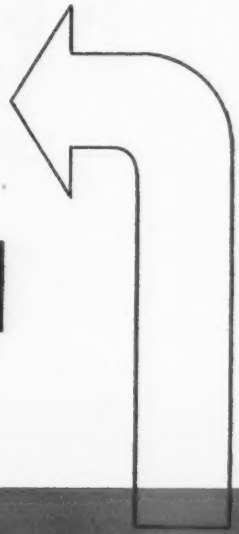

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Industry BRIEFS

NATIONAL Malleable & Steel Castings Co., 10600 Quincy Ave., Cleveland, is planning a program of expansion that will provide additional foundry facilities and relocation of the annealing and finishing departments.

* * *

Tinius Olsen Testing Machine Co., Willow Grove, Pa., has appointed Gnaedinger & Van Zelst Labquip Corp., 525 North Noble St., Chicago 22, sales agent for the area bounded by Milwaukee, Indianapolis, Fort Wayne, Ind., and Davenport, Iowa.

* * *

East Texas Electric Steel Co., Old Greggton Rd., Longview, Tex., has been sold to East Texas Steel Castings Co., subsidiary of Oklahoma Steel Castings Co., 1200 North Peoria St., Tulsa, Okla. Expansion of facilities is planned.

* * *

Link-Belt Africa Ltd., subsidiary of Link-Belt Co., Chicago, has purchased a 12,000-sq ft manufacturing plant, with separate office building, on a 12-acre plot in Springs, Transvaal, about 28 miles east of Johannesburg. John E. Petersen, formerly divisional engineer at the company's Pershing Road plant in Chicago, is managing director of the South African company.

* * *

Spencer Foundry Corp. has been formed in New York as a foundry and machine shop with capital stock of $20,000. Directors are Sara Blum, Doris Berkman, and Rosalind Welkoff, 10 East 40th St., New York.

* * *

Steel Fittings Inc., machine shop, foundry, and supplies, has been incorporated in New York. Directors are Herbert H. Esrick, Nathan B. Rosenblatt, and Benedict A. Leerburger, 25 Ward 43rd St., New York.

* * *

Product Engineering Co., Portland, Oreg., has purchased all die casting machinery of Pacific Die Casting Co., same city. It has also added all personnel formerly employed by Pacific in its die casting department.

* * *

Ohio Ferro-Alloys Corp., Citizens Bldg., Canton 2, O., plans construction of a new ferroalloy plant at Brilliant, O., for the production of ferrosilicon, ferrochromium, ferromanganese, etc. New plant operations are expected to begin in the fall of 1951. The company, organized in 1928, built its first ferroalloy plant that year at Philo, O., and in 1941 built another at Tacoma, Wash. In 1942 it constructed and operated for the government a third plant at Wenatchee, Wash. The Brilliant plant is designed for an ultimate capacity requiring 50,000 kw of power.

* * *

Phoenix Iron Works Co., Second & Castro St., Oakland 7, Calif., celebrated its 50th anniversary on Feb. 18. S. D. Russell is president and George W. Russell, is vice president and treasurer.

* * *

Alloy Engineering & Casting Co., 1700 West Washington St., Champaign, Ill., suffered damage estimated at several hundred thousand dollars, Mar. 10, when fire, of undetermined origin, destroyed the plant.

* * *

Walsh Refractories Corp., St. Louis, is expanding fire brick manufacturing facilities at its Vandalia, Mo., plant. New plant is expected to be in full operation by early summer, 1951.

* * *

Meadows Corp., McClun & Bell Sts., Bloomington, Ill., subsidiary of Thor Corp., Chicago, will spend $100,000 to convert foundry area of its plant into general manufacturing space.

* * *

Continental Foundry & Machine Co., Wheeling, W. Va., plans construction of a 60 x 150-ft addition to the present Peninsula St. plant to house four heat treating furnaces.

* * *

Grede Foundries Inc., Milwaukee, has acquired the former Reedsburg Foundry Co., Reedsburg, Wis., closed since 1948, which will be reopened for production of gray iron castings.

* * *

Cleco Division, Reed Roller Bit Co., Houston, Tex., has appointed Montes y Valles, S. A. Vallarta 1—305B, Mexico, 4, D. F., distributor of Cleco products in that area.

* * *

Iowa Foundry Co., West Second and Cook Sts., Sioux City, Iowa, has been reorganized under new management with J. K. Knopf as general manager.

* * *

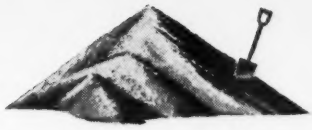
Scheffler-Gross Co., Drexel Bldg., Philadelphia, has assumed the account of Homestead Valve Co., Coraopolis, Pa.

* * *

Name of Electro Refractories & Alloys Corp., 344 Delaware Ave., Buffalo 2, has been changed to Electro

(*Concluded on page* 186)

BELGIAN VISITORS, representing skilled labor, metallurgical, engineering, and administrative branches of the foundry industry, recently toured the United States to study foundry practices and production control methods, inspect equipment, and learn something of the principles of industrial relations followed in this country. The country-wide tour was sponsored by the Economic Co-operation Administration. First stop of the visitors was at the plants of Farrel-Birmingham Co., Ansonia and Derby, Conn. Company members and administration officials are shown with the visitors



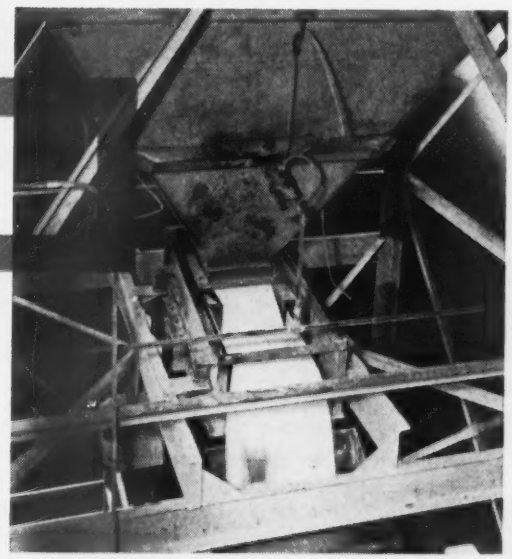
If sand won't flow your foundry can't go!

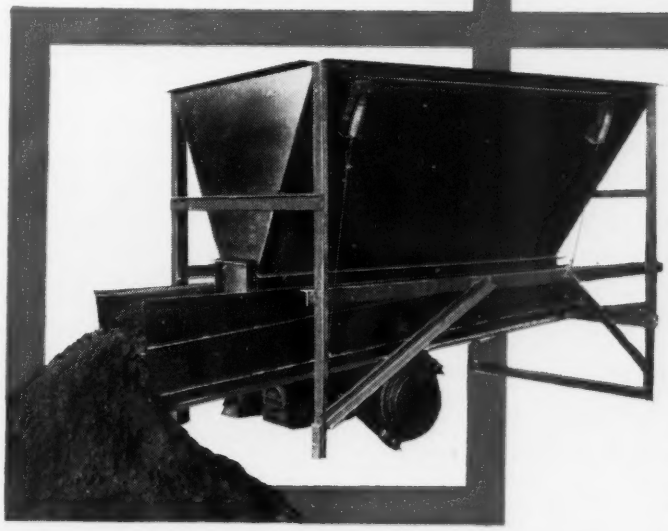
install Simplicity os-a-veyor type bin feeders

Sand stoppage in your storage bins means lost time on the molding floor and lost production all along the line. You can stop these time losses with Simplicity Os-A-Veyor Type Bin Feeders that greatly reduce the danger of sand bridging and hanging in the bins. Simplicity Feeders, available in lengths from 4′ to 20′ and widths from 12″ to 6′, feed from the full length of the bin. Quality of sand is also improved because the sand can temper in the bin with actual temper time dependent upon capacity of bin and rate of feed. Molding sand will flow when you want it and a brake type motor on the feeder insures accurate measurement of sand. Improve your molding sand, improve your castings, and improve your production time with Simplicity Os-A-Veyor Type Bin Feeders.

18″ x 9′ Model OA Simplicity Feeder

2′ x 5′ Simplicity Bin Feeder in operation at a big industrial foundry.





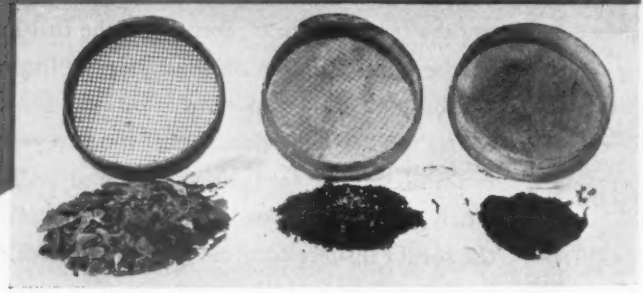
2′ x 10′ two-surface Feeder installed under test bin. In actual operations, a 3′ x 17′ feeder of this type installed at the Buick foundry, Flint, Michigan, handles, at a uniform controlled rate, 100 tons per hour of finished, mulled, and tempered sand feeding from a 150 ton capacity through a 14′ long opening.

89

- **Sales Representatives In All Parts Of The U.S.A.**
- **For Canada:** Canadian Bridge Engineering Company, Ltd., Walkerville, Ontario
- **For Export:** Brown & Sites, 50 Church Street, New York 7, N. Y.

Simplicity
TRADE MARK REGISTERED
ENGINEERING CO. • DURAND, MICHIGAN

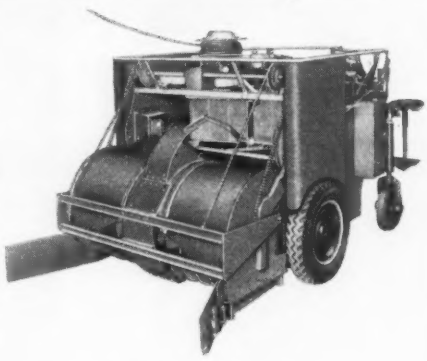
SANDMASTER
decreases scrap losses



115 lbs. 25 lbs. 10 lbs.

removes 150 lbs. of iron from a single sand heap

The first night the Sandmaster was used at Zenith Foundry Co., West Allis, Wisconsin, more than 150 lbs. of iron were magnetically separated from a single windrow 30′ long and 60″ wide at the base. The iron removed consisted of 115 lbs. of large pieces, 25 lbs. of medium size scrap and 10 lbs. of tramp iron. Mr. W. R. Tanner, president of the company, estimates that decreased scrap losses alone will pay for the Sandmaster in several years' time.



No other single sand conditioning unit can prepare molding sand as thoroughly as the Sandmaster. Its unique cutting cylinder design imparts a mulling action to the sand giving it a superior quality. Water and new sand are uniformly blended in with the old. Foreign particles, not eliminated by the magnetic separator, are removed in the screening process which also fluffs, aerates and cools the sand. The result is a "Velvet-Like" texture that makes it easier for the molder to produce more and better molds.

You can save time, money and manpower using the Sandmaster. Write today for Bulletin No. 45.

Sand Conditioning Headquarters for 43 Years

SANDMASTER — American

OFFICES IN PRINCIPAL CITIES

AMERICAN WHEELABRATOR & EQUIPMENT CORP., 505 S. Byrkit St., Mishawaka 2, Indiana

(*Concluded from page* 184)

Refractories & Abrasives Corp., is more descriptive of its operations. It no longer produces alloys. Plants are operated in Buffalo and Cap-de-la Madeleine, Quebec.

* * *

National Precision Castings Corp., Berkley Ave., Clifton Hgts., Pa., on Jan. 10, suffered fire loss estimated at $100,000, when an explosion in the molding department sprayed hot metal, spreading the flames. Larger part of the loss is in destroyed machinery.

* * *

Riverside Foundry Inc., located at Bettendorf, Iowa, plans a $2 million expansion program for production of armor steel castings. Russell Schwartz is president.

* * *

Pre-Vest Inc., 23420 Lakeland Blvd., Cleveland, has been formed by Claude H. Watts to produce investment material for investment castings.

* * *

Hercules Powder Co. has moved its San Francisco office to the Standard Oil Bldg., 225 Bush St. Former address was 256 Montgomery St.

* * *

Chillicothe Industries Inc., Chillicothe, Mo., manufacturers of farm equipment, has started production in its foundry.

* * *

V-G Flask & Fitting Co. has moved from Clinton, Conn., to Madison, Conn., where larger facilities are provided.

* * *

Youngstown Foundry & Machine Co., Youngstown, O., plans construction of two additions, costing $300,000.

* * *

Precision Cast Matchplate Co., 3219 West 97th St., Cleveland, has been incorporated by Fred A. Henz.

Data on Steel Castings

Increasing volume of requests for definitive data on steel castings, arising from defense mobilization requirements and advances in engineering and design applications, has prompted Steel Founders' Society of America, 920 Midland Bldg., Cleveland 15, to make available additional copies of its booklet on the steel casting industry.

Entitled "The Steel Casting Industry," the booklet emphasizes the industry's extensive research and product development activities covering many engineering and mechanical applications.

Name Winners In Steel Castings Design Contest

Steel Founders' Society of America has announced the winners in its international awards program for technical papers dealing with new designs, redesigns, conversions and advanced uses for steel castings and for improved materials and methods applications to meet specific engineering problems.

GEORGE HABIAN

George Habian, engineer for Western Electric Co., New York, won first prize of $300. His paper and accompanying designs covered cable reel saddle steel castings used on a cable measuring machine. Second place award of $200 went to Charles L. Babb, engineer in charge of design, centrifugal pump department, Allis-Chalmers Mfg. Co., Milwaukee. Mr. Babb submitted steel casting designs of outer barrel and suction nozzle ends for a high pressure multistage centrifugal pump used for boiler feed work in central power stations.

Leonard G. Daniels, research metallurgist, Thompson Products Inc., Euclid, O., won third prize of $100 for his design of an aviation selector valve cylinder entailing conversion from welded assembly to steel investment casting.

Others earning distinction and $50 or $25 awards for outstanding design papers were:

Fourth—L. N. Tangeman, project engineer, Dempster Mill Mfg. Co., Beatrice, Nebr.: Beam for a two-row lister planter for agricultural use.

Fifth—Orrin F. Arnold, purchasing agent and cost accountant, Bacon Vulcanizer Mfg. Co., Oakland, Calif.: Matrix clamp pressure bar for use as the key assembly unit in vulcanizing mold equipment.

Sixth—Joseph E. Cruse, president and chief engineer, Continental Farm Equipment Co., Omaha, Nebr.: Mounting pedestals for disk harrow linkage unit.

Seventh—Robert E. Greenawalt, engineer, Salem-Brosius Inc., Salem, O.: Cast-weld construction of high-alloy steel special rails for service in gas-fired continuous pusher bar furnace; centrifugally cast-weld construction of feeder bar tubes and feeder bar fingers.

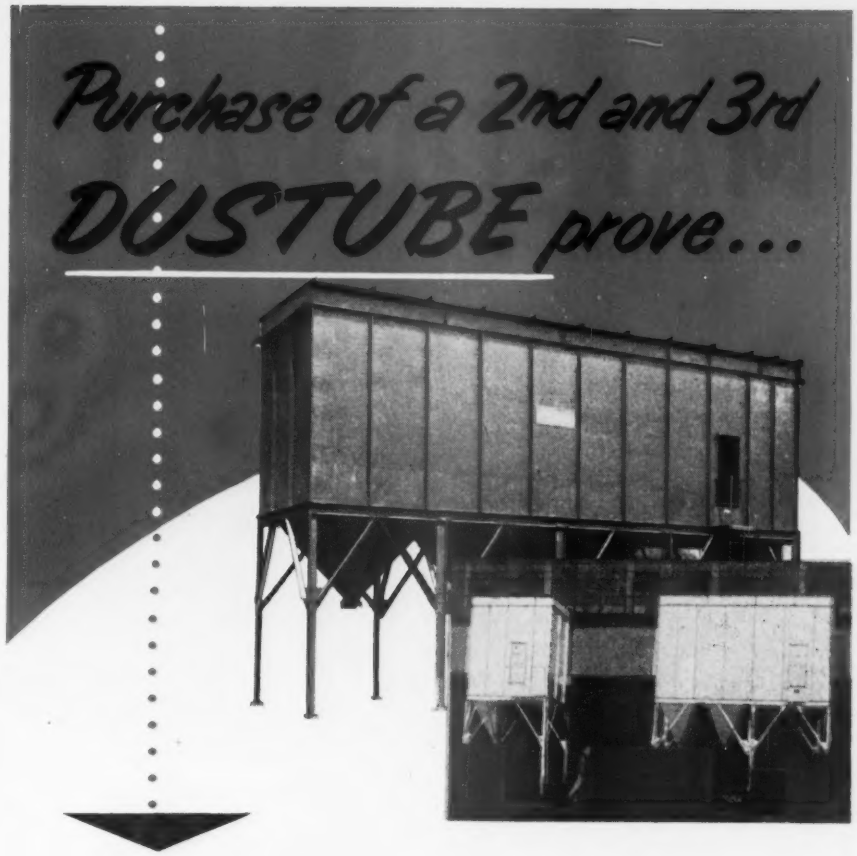
Eighth—Leo A. Chartier, Wilson Trailer Co., Sioux City, Iowa: Semitrailer tandem suspension weight equalization bracket.

Ninth—J. C. King, development engineer, Brown Instruments Division, Minneapolis-Honeywell Regulator Co., Philadelphia: Cast steel body for a linear differential type flow meter.

Tenth — Theodore Cackowski, mechanical draftsman, Truscon Steel Co., Youngstown, O.: Saddle or bucket unit used to engage end lugs on load bars employed in a bonderizing conveyor system.

Eleventh—Loy D. Rhoads, chief engineer, General Excavator Co., Marion, O.: Power shovel deck casting and machinery side frame.

Twelfth—H. W. Gunther, engineer, Paris, France: Crane wheels and drums for hoisting gear.



"the economy of the collectors is especially gratifying"

at the OHIO CULTIVATOR DIV. of National Farm Machy. Cooperative, Inc., Bellevue, Ohio

The unusual performance record of the Dustube cloth tube type collector is proved by the large number of repeat users it has. For instance, the Ohio Cultivator Division now has 3 Dustubes because as Mr. G. C. Cole, Fdry. Supt. says, "In these days when costs are so closely watched, the economy of the Dustube is especially gratifying."

They find that, "With our three Dustube Collectors practically no maintenance problems have appeared to date. Our maintenance men like the simple, efficient operation of the collectors—we save both hours and dollars in maintenance costs."

"Efficient control of dust, high production efficiency and good working conditions are practical operating results of the Dustube Collectors."

Investigate the cost-saving advantages of the Dustube Today. And soon you will be joining the chorus of users who say: "It Pays to Own a Dustube."

Write for Full Details

American dustube COLLECTORS

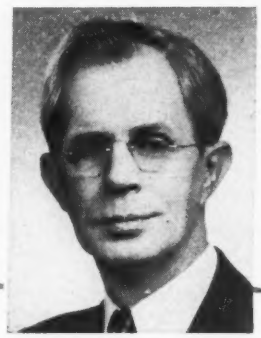
OFFICES IN PRINCIPAL CITIES

AMERICAN WHEELABRATOR & EQUIPMENT CORP., 505 S. Byrkit St., Mishawaka 2, Indiana

MAN-TO-MAN

on the Molder's Bench

"Exhorbitant Monotony"



By RALPH L. LEE

LATELY as I go about the country, visiting one foundry after another, I notice that dirty, smelly, messy, smoky and breezy foundries are getting harder and harder to find. Some are still with us, but the clean-up movement has sure taken hold and spread, much to the credit of foundrymen everywhere.

Of course, this movement didn't just start by itself or spread like some new style in women's hats; it was deliberate—in fact, it almost had to be done if we were going to get all the people we needed into our foundries.

Not long ago I visited a brand new foundry which, I swear, from the front made a person think he was looking at a new high school building. Inside, this foundry was truly spick and span, the air was clean, things all in order and just about everything that could be motorized, air-compressorized or mechanized was done up to fare-thee-well.

When the boss (an old friend of mine) and I got back to the office after a trip through the place I could hardly wait to tell him how lucky he and his gang were to have such a bang-up plant. Bubbling over with enthusiasm, I said, "Boy! I'll betcha, if the fairy godfather of all good foundrymen was standing right here before you now with his star-tipped magic skimmer in his hand, ready to wave it to grant you any wish, I'll bet you a nickel to a doughnut that you'd have one heck of a time thinking of one single solitary thing to ask for."

With his enthusiasm well under control, he allowed as how that this could be true, saying, "Yes! we do have everything, including one thing I wish to the Lord we did not have." "And what's that?" I asked. "Turnover, Doc, employee turnover, doggone it. They come and they go. Why in heck won't they stay put?"

I told him that I didn't just know what a fair turnover would be. "Is yours exceptionally high?" I asked. He said he didn't think so, as far as highly mechanized foundries go. "But," he went on, "it's still too darned high and it should *not* be."

This remark of his chased my mind down south to a foundry owned by a very special friend of mine. It's a medium size jobbing foundry, just as spick and span as the one I was sitting in, but with quite some distance to go in mechanization. But when it came to turnover, this southern foundry was way ahead. In fact, with very few exceptions no one has ever been fired or quit in spite of a steady growth ever since they started years ago.

Then in my imagination I ran on over to a foundry in Pennsylvania where I work on the molder's bench several days each year. The last time I was over there I saw almost the very same gang that was there when I started this visiting business 12 or 13 years ago.

With several other foundries in mind it dawned on me that these places weren't exceptions by a darned sight, for as I go around I see ten, fifteen and, yes, twenty year service awards being handed out all over the country in shops with remarkable records for their people staying put.

That day, sitting in this well equipped office of the brand-new dream foundry, I was yanked up short to a realization of the fact that *a nice place to work in*—as important as it is—is not the whole answer to the problem of getting people into the foundry and keeping them there. A nice place to work is mighty important, that's true, but the kind of work done in that nice place might be still more important.

At this point I apologized to my friend for my mind wandering off, and it turned out that by some strange coincidence his mind had been roaming around in the same neighborhood. So we took our hair down and started delving into this seeming paradox, this cockeyed phenomenon of nice places to work where folks don't want to stay. When we came up for air we had *monotony* in tow as the suspected culprit.

We allowed as how monotony in some degree was more than likely to be with us always. I even suggested that we might get a bit fed up, after a few trillion years, with the goings on behind the pearly gates. We both agreed that what some folks consider monotony might almost be sport to others, and that viewpoint might be able to push monotony all over the map as far as being able to tolerate it is concerned. But we also agreed it is just possible there might well be a saturation point on the old monotony curve beyond which nobody could go and stay all in one piece—just as there is a point in the alcoholic content of the blood where even the heaviest drinker passes out.

This thought raised the question as to whether, carrying time and motion studies to the nth, a job could be systematized and mechanically controlled to a point where the theoretical savings would not only be completely washed out by unendurable monotony, but expenses would be added in the form of quits, hirings, training, extra supervision, grievances, green-horn scrap and production stoppages. We said, "wouldn't this be a fine kettle of fish if, through ignorance, we have been laying all of these troubles to the time, people slipping and none wanting to work any more."

This possibility was so exciting that we made a rough diagram to illustrate what was shaping up in our minds. Here's what we said:

"Suppose, after thorough time and motion study, analyzing, tooling, rigging, mechanizing and streamlining, a job was finally broken down to the irreducible minimum of ten units, or steps as far as the operator is concerned. (All this was just imaginary.)

"Now let's say," we went on, "that nine of these ten steps were absolute-

(*Concluded on page* 192)

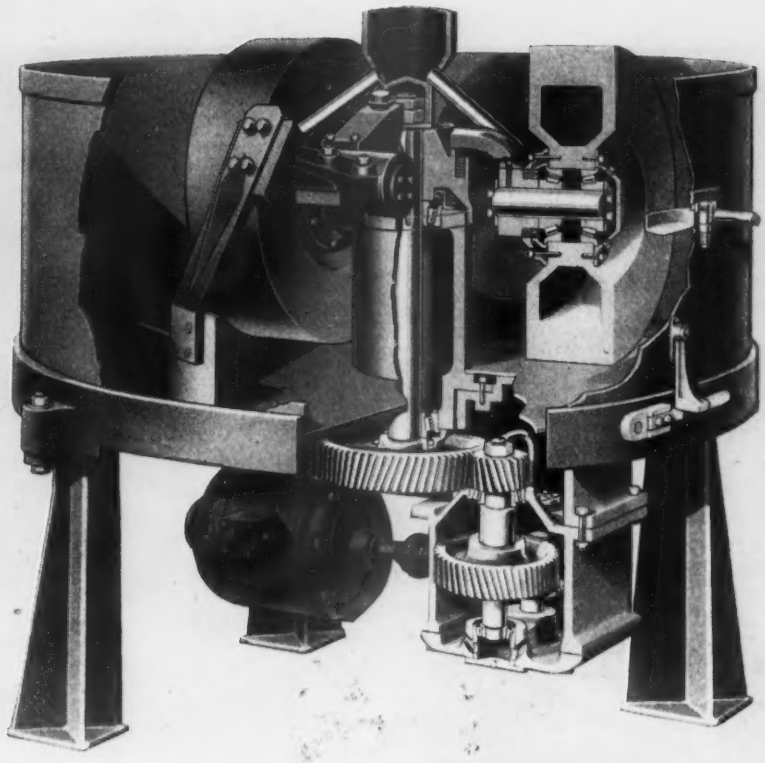
here's proof of Dependability and Long Life . . .

2 SIMPSON MIXERS NOW IN THEIR 22nd YEAR OF CONTINUOUS SERVICE FOR LARGE MIDWEST STEEL FOUNDRY

Since 1929, a well-known midwest steel foundry has relied upon two No. 3 Simpson Mixers for the tough job of properly preparing steel facing sand used in producing high quality steel castings weighing from 1 to 3200 lbs.

Realizing that modernization is the key to greater production, this progressive foundry recently modernized their two Simpsons, with the result that even greater mixing efficiency has been accomplished . . . working 10 hours a day, six days a week . . . producing 500 to 550 tons of finished castings per month.

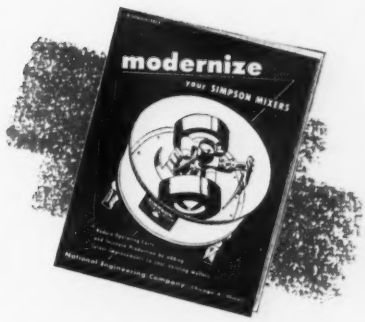
This is just one example of the dependable, long life performance that Simpson Mixers are giving to the Foundry Industry.



Why Simpson Mixers Last Longer—Do A Better Job . . .

The superior design and construction features of Simpson Mixers are responsible for their long life. These, together with the *true* mulling principle employed, are the most important features in reducing horsepower requirements, operating costs, and maintenance. This mulling principle, which provides the most efficient and economical method of preparing foundry sand, develops the properties of flowability, toughness, elasticity and uniformity of sand not obtained by any other method.

Here, then, is *Controlled* sand mixing at its best . . . let a National Engineer show you how to increase production and cut costs with world-famous Simpson Mixers.



This new booklet will show you how to get the *most* out of your Simpson Mixers . . . showing how you can modernize existing mixers right in your own foundry, at minimum cost. *Write for your copy of Bulletin 503 today!*

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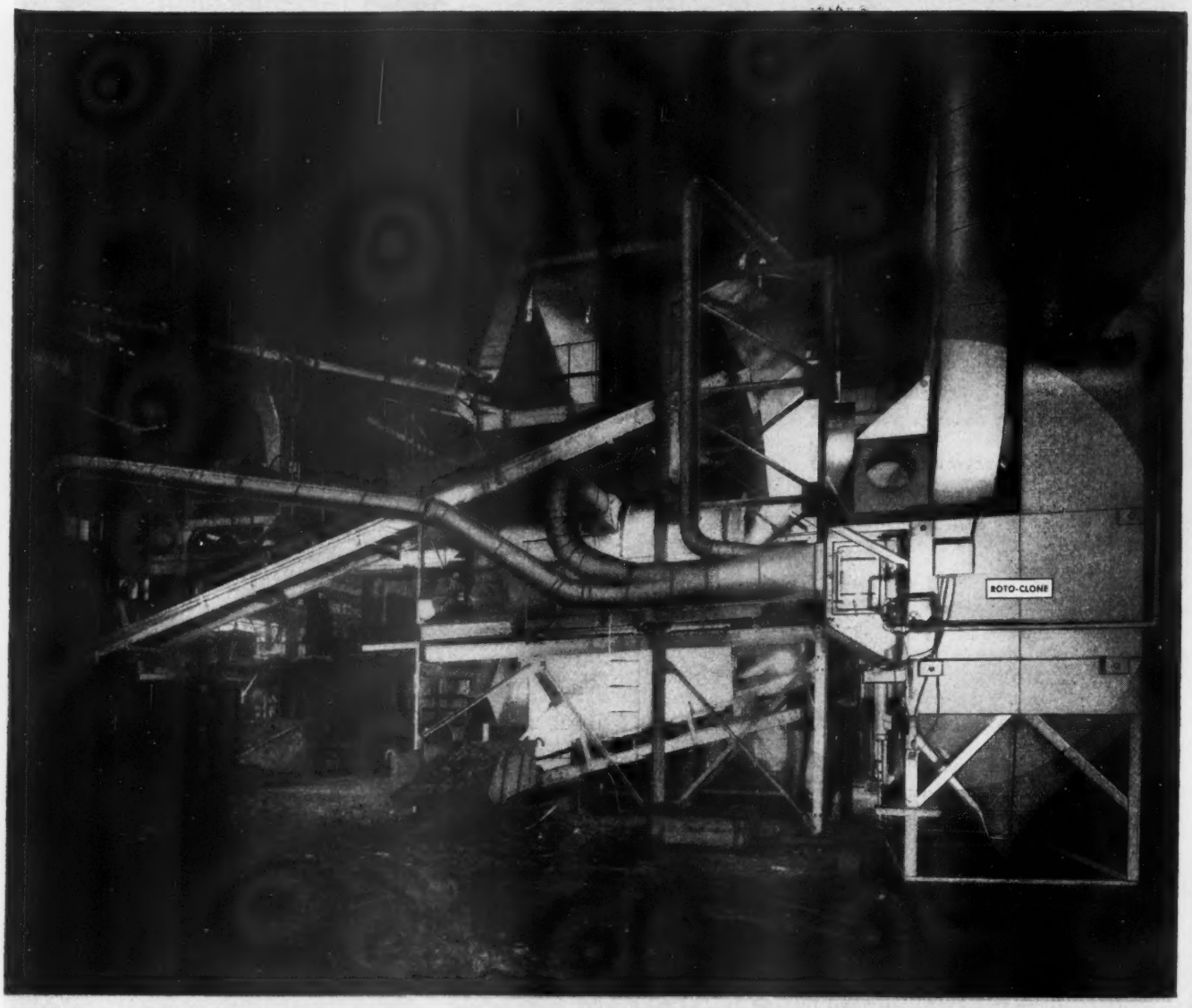
A MAN-HOUR SUPPLY...

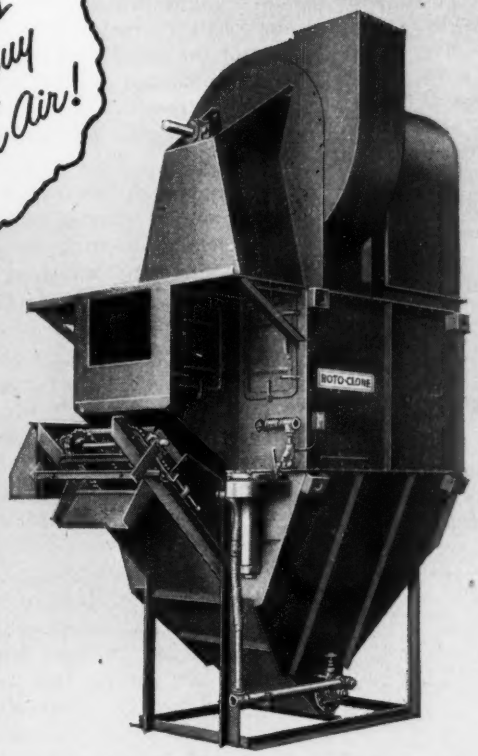


Type N Roto-Clone Arrangement D Sand Conditioning Installation

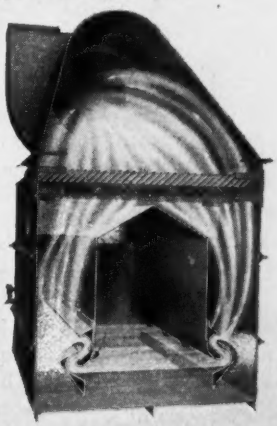
ONE-THIRD of the foundry's dust occurs in sand conditioning systems like the one above. The Type N Roto-Clone shown is a hydro-static precipitator of high efficiency, which removes dust by dual washing and scrubbing action and combines in one unit all three functions of exhausting, separating and storing dust . . . in the form of sludge. The Type N has no moving parts, pumps or auxiliary equipment and is available in eleven sizes with capacity ratings from 750 to 48,000 cfm. The complete line of AAF Roto-Clones offers a wide selection of performance and operating characteristics to meet practically every dust control need. For the correct solution to your dust or air pollution problems call your nearby AAF representative or write direct to American Air Filter.

..... worth thinking about!

Today's Best Buy is Better Air!



Type N Roto-Clone Arrangement C Hydro-Static Precipitator



Cross section of Type N Roto-Clone Arrangement B with dual impellers showing water curtains created by air flow

AAF ROTO-CLONES

improve working conditions ...eliminate dust and fumes!

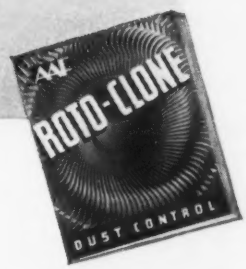
Human efficiency and willingness to work are intangible factors that have a decidedly "tangible" effect on production schedules. Modern foundries find that improved working conditions through the elimination of dust and fumes by AAF Roto-Clones*, measurably increases efficiency, as well as reduces absenteeism and labor turnover.

If man-hours and dust are two of your problems, consider these performance characteristics of AAF Roto-Clones:

- High efficiency in collecting both coarse particles and extreme fines in excessive concentrations.
- Continuous operation at peak efficiency without interruption for reconditioning.
- Uniform air delivery assures sufficient air flow at hoods and unvarying air velocities in branch pipes and main ducts at all times.
- Minimum space requirements, as single units perform functions of both exhauster and dust collector.
- Shop assembled and pre-tested for ease of installation.
- Many types, sizes and arrangements to meet individual dust problems.

Write for AAF's Engineering Bulletin #270.

**Roto-Clone is the trade-mark (Reg. U. S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydro-static precipitator types.*



AAF

American Air Filter

COMPANY, INC.

266 Central Ave., Louisville 8, Ky. • In Canada: Darling Bros., Ltd., Montreal, P. Q.

(*Concluded from page* 188)

ly controlled by the conveyor, equipment and setup, leaving only one step for the operator to use his judgment on."

"Then," we said, "just supposin' (we had no figures before us or even a particular job in mind) we found after the job had been running long enough to get all of the bugs out, up to schedule and long enough to get the dope we were after, that in spite of anything and everything we could do, that the turnover on this job simmered down to a consistent 100%. That is, that anyone who started on the job at the beginning of this period was replaced before the beginning of the next, or at least it averaged out this way." Realizing, of course, that all of this was purely a brain storm but having an exciting time, nevertheless, we ploughed right ahead.

"Next let us suppose we found that by changing the job some, we left two of the original ten steps up to the operator to do as he saw fit, with the remaining eight under mechanical control. Then by checking and with everything else remaining the same we found that the turnover on that job had dropped 25 per cent."

With no hard facts to stop us we carried the imaginary game to a point where it began to look as though there simply had to be a point on the monotony curve beyond which human flesh, mind and nerves could not go. Then it occurred to us that the establishment of such a point might end up being one of the most important accomplishments in the history of industry. But even if it couldn't be, the suspicion that it might be there could have one whale of a lot to do with our thinking and planning.

If such a point could be established, we reasoned, another factor would have to be incorporated in time and motion techniques and the establishment of work standards.

We might find that by opening up our jobs for greater discretion on the part of the operator we might release a will to do and to excel which would produce results clear beyond the rosiest slide-rule predictions imaginable.

With such a saturation point on the monotony curve in mind we might find that by rotating folks on jobs which can't be anything else but monotonous would pay off in handsome returns.

Everyone taking turns on the night shift might do surprising things to turnover and pay off in ways we least suspect. At this point my friend and I practically interrupted each other by saying "Well, we can dream, can't we? Many fine things started with a dream."

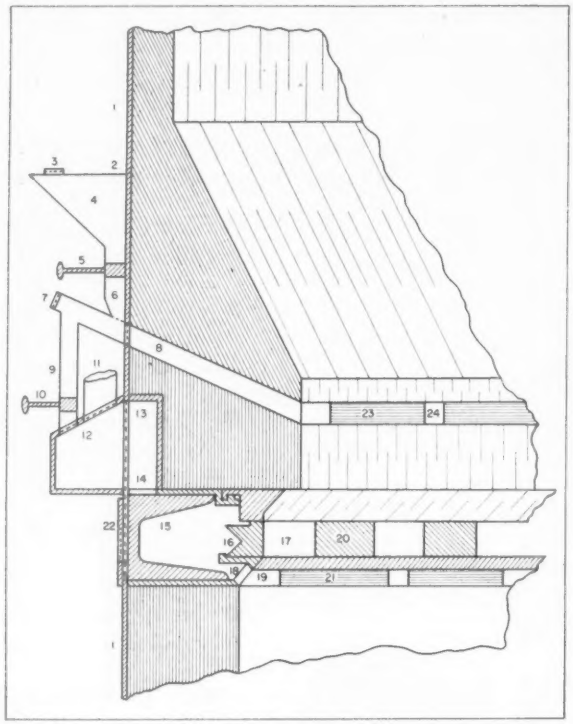
Since then I have thought that maybe the saturation point on the monotony curve has already been established, maybe I'm just ignorant and behind the times. But then again, I say to myself, I haven't seen any signs of it and I do visit a lot of shops and talk to a lot of foundrymen. But be this as it may, I have a conviction, not just a hunch, that this vital point is there, that it can be established, even though by rule-of-thumb, and it will be. And here's why I believe so:

In spite of the fact that fatigue is the only basis upon which a fair day's work for a fair day's pay can be established, we do not know what fatigue really is. In spite of all the work done to find out what it is and what controls it, we are still in the dark. There is no question in my mind that monotony is the key to the puzzle. Unless I miss my guess, monotony is a good place to start to make foundries not only nice places but good places to work.

I know darned well that I have stuck my neck out in my zoom up into the wide blue yonder, but, after all, with my standing as an amateur such zooms are my most treasured privileges. I do hope that I have not contributed to the intellectual delinquency of that friend of mine who has the brand new foundry. One thing is certain, we're going to add this here monotony research project to our already heavy backlog of orders up in the Lee Hobby Foundry.

NEW CUPOLA DESIGN HAS MANY FEATURES

THE accompanying illustration shows the many new features in cupola construction recently designed by F. J. Zippler, 700 W. North Ave., N.S., Pittsburgh 12. The various features are numbered for ready reference: (1) cupola shell; (2) alloy and flux container; (3) feed opening; (4) material; (5) damper; (6) outlet spout; (7) peep hole with compressed air connection in the event blast pressure is not sufficient to force material into incandescent coke canals; (8) upper tuyere; (9) blast feed pipe for upper tuyere; (10) damper; (11) main blast pipes; (12) windbox; (13) blast feed tube; (14) opening to permit blast to enter annular chamber (15); (16) back view of tuyere block; (17) tuyere opening; (18) opening to feed blast to auxiliary tuyeres (19); (20) front view of tuyere block; (21) refractory lining between auxiliary tuyeres; (22) removable door with peep hole; (23) refractory lining between upper tuyeres (24).



It will be noted that the elevated windbox and the feed tube are sufficiently high to prevent entrance of molten iron or slag. In the highly improbable but remotely possible event that a small quantity of iron or slag enters the chamber, the material may be removed readily through the door (22).

The inventor claims that feeding alloys the new way will prevent at least 50 per cent of the usual lining burn-out at the melting zone; the alloyed iron coming from the cupola into the ladle will be much hotter than iron where the alloy is added in the ladle. The claim is advanced that this new type cupola will save 25 per cent fuel, increase melting capacity 25 per cent, deliver real hot iron and drop clean at the end of the heat.

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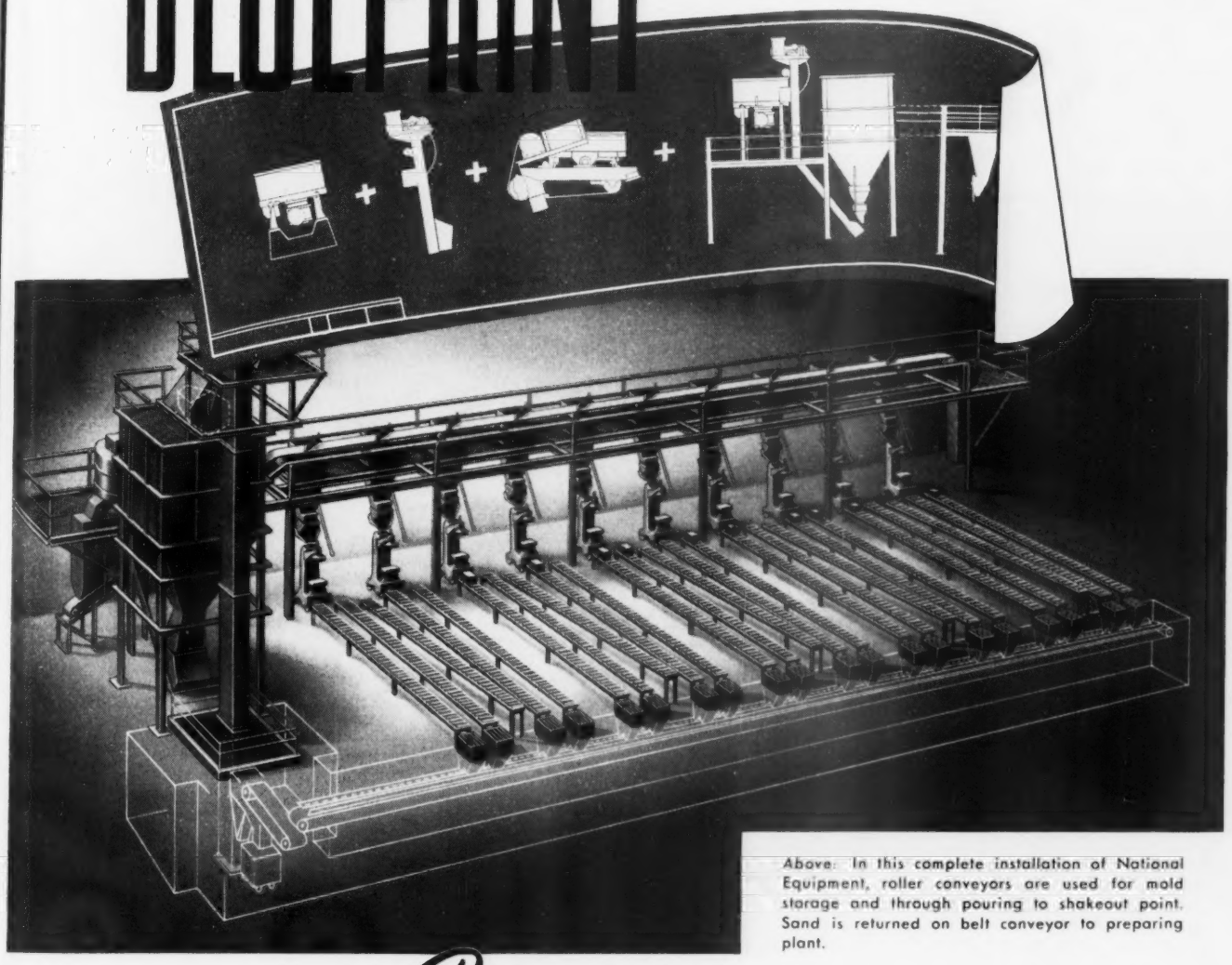

Above: In this complete installation of National Equipment, roller conveyors are used for mold storage and through pouring to shakeout point. Sand is returned on belt conveyor to preparing plant.

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Activities of Foundry

GROUPS

Southern California

THE colored motion picture "Fluid Flow in Transparent Molds," was featured at the Feb. 9 meeting of Southern California Chapter of the AFS held at the Rodger Young Auditorium, Los Angeles. The film, which has been produced as part of the research project of the Aluminum and Magnesium Division of AFS, was discussed first by S. C. Massari, technical director of the society.

The pictures exhibited the reasons for gas aspirations in the flowing metal, and the entrapment of gas pockets which require time to wash out of the gating system. Experiments with variously designed sprues, sprue bases, gates and runners illustrated the most effective designs to eliminate or minimize defects caused by gas aspirations and entrapment. —*S. L. Jackson, Electro Metallurgical Division*

Ohio State University

JANUARY meeting of Ohio State University Student Chapter of the AFS had as its guest speaker J. G. Lummis, A. P. Green Fire Brick Co., whose subject was "How To Sell the Hard To Sell Foundrymen."

Mr. Lummis elaborated on various types of opposition the average salesman meets in his daily contacts with prospective buyers. Procedures to overcome sales opposition were discussed together with some of the aspects of a career as a salesman.

The chapter showed its appreciation of Mr. Lummis' interest in the chapter by making him an honorary member.—*William Harper*

Twin City

A CONSIDERATION of "Trends in the Pattern Industry" featured the Feb. 13 meeting of Twin City Chapter of the AFS held at the Covered Wagon, Minneapolis. Principal speaker was E. T. Kindt, president, Kindt-Collins Co., Cleveland. He outlined, briefly, the history of the pattern industry and told of its importance in the foundry industry and in turn how important the foundry industry is in our national economy.

Mr. Kindt then covered the following phases of patternmaking: Construction of a modern pattern shop; methods of figuring costs on wood and metal patterns; the intelligent selling of pattern equipment; permanent molds—a fertile field for the pattern industry; standardization of pattern components and construction; and application of plastics and plaster in the pattern industry. A discussion and film followed. The color film dealt primarily with patternmaking supplies and machinery, their quality and use.—*J. D. Johnson, Archer-Daniels-Midland Co.*

Texas

SEVENTY-SIX members and guests of Texas Chapter of the AFS attended the January meeting held at the Blackstone Hotel, Ft. Worth. The motion picture "Men and Molds" produced by Lynchburg Foundry Co., Lynchburg, Va., was presented and a discussion period followed during which molding sands, gating and risering were considered.—*C. L. Boone, Texas Steel Co.*

Chicago

FOUR roundtable sessions, arranged by Chicago Chapter of the AFS, for its regular meeting Mar. 5, attracted the best attendance for any similar gathering of the current season. But even more noteworthy was the remarkable achievement of the Chicago Bar Association dining room in providing ample food for nearly 200 diners, more than half of whom put in their appearance without advance reservations.

Chapter President C. V. Nass, vice president, Pettibone Mulliken Corp., reported that several officers and representatives of the chapter attended and participated in the installation of a student chapter of the AFS at Northwestern University in Evanston,

(*Continued on page* 196)

SOUTHERN CALIFORNIA Chapter of the AFS met at Rodger Young Auditorium, Los Angeles, Feb. 9, to see the AFS research film "Fluid Flow." At left above, left to right, are: James Barr, Compton Foundry, Compton, Calif.; S. C. Massari, AFS technical director and principal speaker; Henry Howell, Howell Foundry Co., Los Nietos, Calif.; Stan Jackson, Electro Metallurgical Division, Union Carbide & Carbon Corp., Los Angeles; Arthur Falk, Centrifugal Casting Co., Long Beach, Calif., and L. J. Andrews, Griffin Wheel Co., Los Angeles. At right, left to right, are: John P. Swaino; Martin C. Robinson, Malleable Fittings Corp.; Joe Baron, Pacific Cast Iron Pipe & Fittings, and Harold G. Gangloff, Stanley Foundries, all of Los Angeles. Photos are by courtesy of K. F. Scheckler, Calmo Engineering Co.

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Illustrated in the photographs above are a 4 gang booked type aluminum core box and properly cleared white metal drier pattern made from a single core plug. Approximately one-half core box size, 8x12x1¾ inches.

Core plug and skeleton backing frames for core box and drier were furnished as shown. Cost for full core box $42.00, and white metal drier $38.00.

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(*Continued from page* 194)

Ill., Feb. 28. After stating that the Chicago Chapter pledged its support to the new group, he called upon James Thomson, chief plant engineer, Continental Foundry & Machine Co., East Chicago, Ind., to recite details of the installation. The new chapter has 20 student members and came into existence largely through the efforts of Bruce L. Simpson, president, National Engineering Co., Chicago, who will continue to serve it as industrial adviser.

Mr. Nass also announced that Chicago likely would be the site of the 1953 national AFS convention.

As a part of its educational activities, the chapter last fall conducted a successful sand course and now is midway in its foundry demonstration course. Enrollment in the latter falling somewhat short of that anticipated, President Nass announced decision to hold off until fall consideration of a proposed cupola course.

Appointed by Mr. Nass to serve as a nominating committee to select candidates for 1951-52 officers were Past President Fred B. Skeates, general superintendent, Link-Belt Co.; Past President W. D. McMillan, chief metallurgist, farm implement division foundries, International Harvester Co.; and John H. Owen, Chicago district sales manager, Harbison-Walker Refractories Co.

TEXAS Chapter of the AFS held its January meeting at the Blackstone Hotel, Ft. Worth, Tex. Shown above, left to right, are: E. L. Laminack, Texas Steel Co., Ft. Worth; B. V. Thompson Jr., Texas Steel Co.; Paul Renegar, McKinley Iron Works, Ft. Worth; W. H. Lyne, Hughes Tool Co., Houston, Tex., chapter chairman; John M. Bird, American Brass Foundry, Ft. Worth, chapter vice chairman; John Collier, Garrot Brass Foundry & Machine Co., Houston, and W. R. Sanders, American Mfg. Co., Ft. Worth. Photo furnished through the courtesy of C. E. Silver, Texas Electric Casting Co.

Chapter Vice President Walter W. Moore, works manager, Burnside Steel Foundry Co., introduced those participating in the evening's roundtables.

The Malleable and Pattern divisions joined hands to conduct a clinic on "Headaches Caused by Pattern Design and Construction." "Chief Surgeon" was Charles Sasseti, in charge of pattern shop, National Malleable & Steel Castings Co., and members of the consulting staff included "Doctors" Joseph Pudlek, wood pattern shop, Illinois Malleable Iron Co.; George Skupa, foreman in charge of molding development, International Harvester Co.; W. L. Andriese, assistant sales manager, Chicago Malleable Castings Co.; F. J. Dengler, general foreman, pattern shop, Crane

(*Continued on page* 198)

CHICAGO Chapter of the AFS met at the Chicago Bar Association Feb. 5 to hear Frank G. Steinebach, editor, *Foundry*, speak. At left is a group enjoying premeeting refreshments. Speakers' table is shown below. Left to right, are: Walter Moore, Burnside Steel Foundry Co.; Mr. Steinebach; C. V. Nass, Pettibone-Mulliken Corp., chapter chairman; F. B. Skeates, Link-Belt Co.; L. G. Gustafson, Continental Foundry & Machine Co., and Deming Lucas, Frederic B. Stevens Inc.

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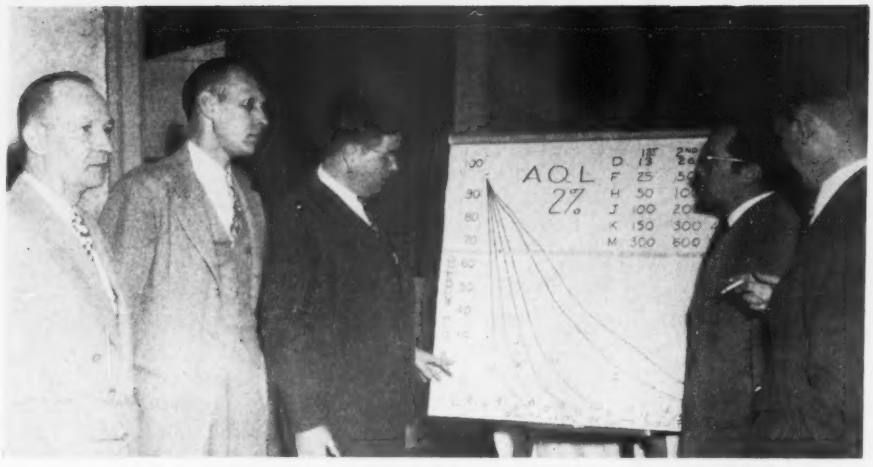


DETROIT Chapter of the AFS heard a talk on statistical quality control at its Jan. 18 meeting, Detroit-Leland Hotel, Detroit. Shown above, left to right, are: George F. Bluth, Willys-Overland Motors Inc.; Robert Schenk, Aluminum Co. of America; Nelson G. Meagley, Willys-Overland, principal speaker at the meeting, and James E. Rainey and Lew Harkness, Detroit Testing Laboratory. Photo furnished through courtesy of Walter Ring, University of Detroit

(*Continued from page* 196)

Co.; James Sinita, assistant pattern shop foreman, Inland Steel Co.; and Harry J. Jacobson, owner, Industrial Pattern Works.

Charles A. Faist, research metallurgist, Burnside Steel Foundry Co., addressed the Steel division roundtable on "Production Control of Molten Steel Temperatures and Its Effect on Steel Casting Quality." Chairman was A. DiGirolamo, general foundry foreman, Chicago Steel Foundry Co.

The Nonferrous division roundtable featured Eugene W. Smith, vice president, Western Materials Co., who spoke on "Nonferrous Foundry Sands." Fred Riddell, research engineer, H. Kramer & Co., presided.

"Gates and Risers" was the subject which Harry A. Kessler, manager foundry operations, Sorbo Mat Process Engineers, St. Louis, discussed before the Gray Iron division. Chairman was Lawrence Huff, sales manager, McCarthy Foundry Co. Inc. —*Erle F. Ross*

WESTERN MICHIGAN: Chapter directors met with William W. Maloney, national AFS secretary, at the Century Club, Muskegon, Mich., Jan. 22. View of the meeting is shown at upper left. Seated, left to right, are: F. J. De Hudy, Centrifugal Foundry Co.; S. H. Davis, Campbell, Wyant & Cannon Foundry Co.; W. J. Cannon, Nugent Sand Co.; Mr. Maloney, and R. H. Herbst, West Michigan Steel Foundry Co. Standing, left to right, are: H. J. Mackay, Mackay Industrial Sales Co.; R. W. Hathaway, Cadillac Malleable Iron Co.; R. P. Shaffer, Lakey Foundry & Machine Co.; C. H. Cousineau, Carpenter Brothers Inc., and L. D. Ramsey, Paul M. Wiener Foundry Co. At upper right is Harry E. Gravelin, Dearborn Iron Foundry, Ford Motor Co., principal speaker at the Feb. 5 meeting at Cottage Inn, Muskegon, Mich. At bottom, left to right around the speakers' table, are: Don Huizenga, chairman, Michigan State Student Chapter; Prof. C. C. Sigerfoos, Michigan State College; Mr. Davis, and Clyde A. Sanders, American Colloid Co., speaker at the Jan. 8 meeting at Cottage Inn. Photos furnished through the courtesy of Frank Beetham, Campbell, Wyant & Cannon Foundry Co.

Western Michigan

A REVIEW of research work on mold materials and their effect on metal shrinkage was presented by Clyde A. Sanders, vice president, American Colloid Co., Chicago, at the Jan. 8 meeting of Western Michigan Chapter of the AFS. Assisting were Prof. C. C. Sigerfoos and Prof. H. L. Womochel, Michigan State College, East Lansing, Mich.

They told of their experiments which were conducted under carefully controlled conditions, with varying molding sands, binders, etc., and the difference in apparent shrinkage obtained with different combinations of these molding materials. Used wisely the results of these experiments give foundrymen an added tool.

The chapter's February meeting also was held at Cottage Inn, Muskegon, Mich. with 107 members and guests present.

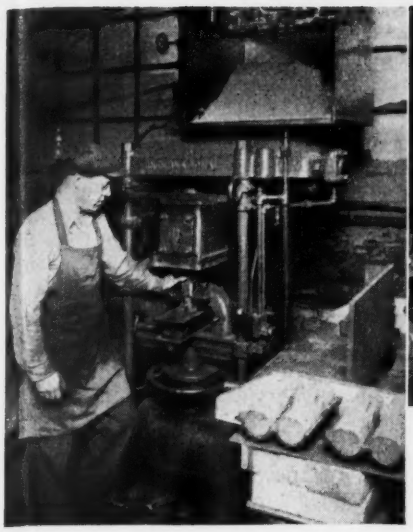
Harry Gravelin, assistant plant manager, Dearborn Iron Foundry, Ford Motor Co., spoke and led a discussion on "Sand, Men or Metal." In reality, Mr. Gravelin conducted a "casting clinic" and members had brought problem castings which were analyzed by Mr. Gravelin and the audience.

The speaker's approach from the angle of sand, men or metal brought out the fact that many of the so-called defects could be attributed directly to men whether they were caused by ignorance, carelessness or lack of application to the problem at hand.—*C. H. Cousineau, Carpenter Bros. Inc.*

Detroit

NOBODY slept through the Jan. 18 meeting of Detroit Chapter of the AFS. The coffee speaker, Sgt. Harry Reeves of the Detroit Police Department is a pistol expert, and in

(*Continued on page* 200)



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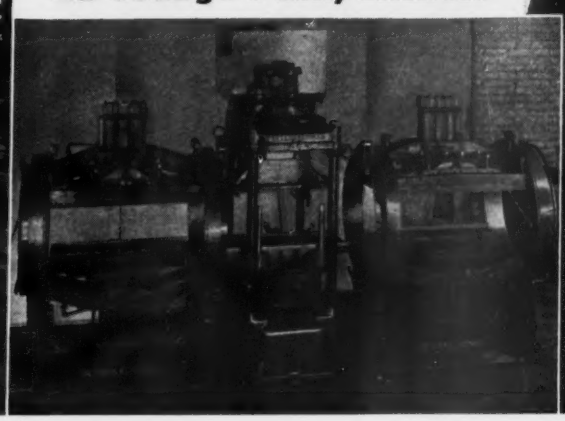

(*Continued from page* 198)
the midst of a crowded Detroit-Leland ballroom he performed feats of marksmanship and quick-draw artistry which had the assemblage spellbound.

Main speaker of the evening, while not as noisy or spectacular, offered the foundrymen much more food for thought. Nelson G. Meagley, manager, statistical quality control, Willys-Overland Motors Inc., explained the principles of what he terms "one of the sharpest management tools developed in the first half-century."

He couched his explanation in foundry terms to aid foundrymen in adapting statistical quality control systems to their operations. Citing problems which might face foundrymen on the subject of quality, he described three types of charts which would eliminate the human element in making policies pertaining to quality.

Once working rules have been set up to determine when scrappage rate is abnormal and when tolerances or analyses are "off the beam," he said it is a simple matter to know immediately when a machine or process is "out of control."

An important benefit from statistical quality control is the psychological lift each man gets from the system, Mr. Meagley and George F. Bluth, W-O chief inspector, emphasized. Prominently placed charts, the key apparatus in the system, are regarded as scoreboards and each man puts out his best effort to prevent these charts from signaling that his operation has gone haywire. A further effect, stressed Mr. Bluth, is that good workmanship can be discovered much more readily than by any other method.

In a lively question-and-answer period, the usefulness of statistical quality control for determining the need for new machinery and equipment was brought out. At the same time, however, the system also shows when there exists no need for equipment replacement. Mr. Meagley emphasized, however, that the system does not determine the wiseness of replacing machinery for purely economic considerations, rates of production and the like.

Both speakers cited the growing trend toward quality certification, which allows a buyer to know that its suppliers are conforming to its specifications because of their guarantee that the quality control system has shown that all operations are in control.—*Howard C. Tuttle.*

NORTHWESTERN PENNSYLVANIA Chapter of the AFS met Feb. 9 at Beacon Inn, Meadville, Pa. Shown at top is a group from Cooper-Bessemer Corp., Grove City, Pa. At center, left to right, are: Norm Birch, National Bearings Division, American Brake Shoe Co., Meadville; Dr. Herman Offner, dean of Edinboro State Teachers College, Edinboro, Pa., coffee speaker; J. W. Grewell, Westinghouse Electric Corp., Sharon, Pa., principal speaker, and Joseph Hornstein, Meadville Malleable Iron Co. At bottom is a group from Urick Foundry Co., Erie, Pa.

Northwestern Pennsylvania

MALLEABLE Foundry Metallurgy" was discussed by J. Edward Rehder, foundry engineer, Canadian Bureau of Mines, at the Feb. 26 meeting of Northwestern Pennsylvania Chapter of the AFS. About 130 members and guests attended.

Mr. Rehder covered the melting and annealing of malleable iron and pointed out many important elements detrimental to good malleable foundry practice. Much care must be taken in using various alloys for stabilizers, especially aluminum, chrome, and tellurium. Much trouble is anticipated by the malleable industry by irons with high sulphur content, but difficulties with sulphur over 0.07 or 0.08 have been licked by manganese additions. In making additions to the melt, however, Mr. Rehder said it should be given ample time to dissolve and should be puddled otherwise there is danger of mottling.

The entertainment of the evening was a quiz program between two teams, one representing General Electric and the other Erie Malleable Iron Co., with GE winning by a few points.

The Feb. 9 meeting of the chapter was held at Beacon Inn, Meadville, Pa., with Joseph Hornstein, Mead-

(*Continued on page* 203)

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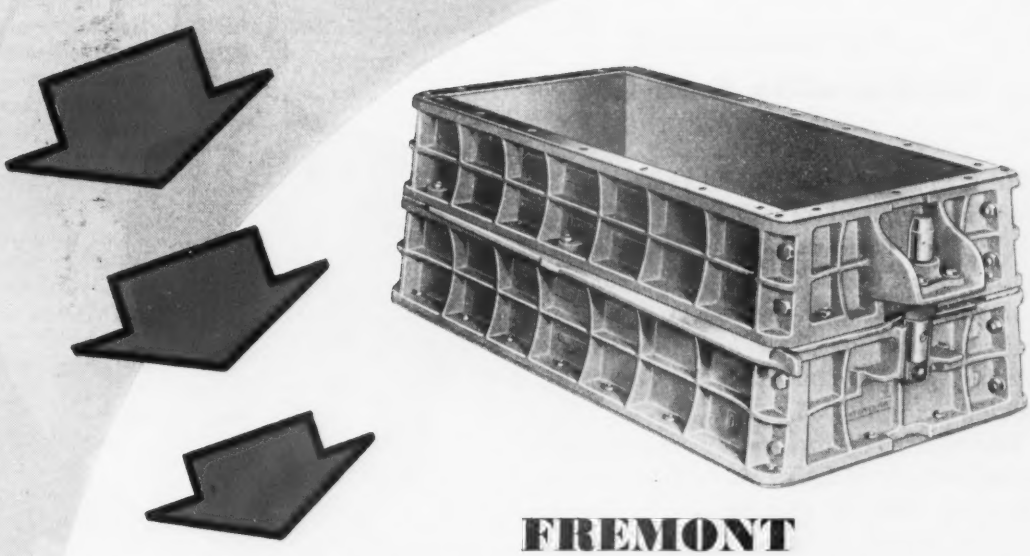

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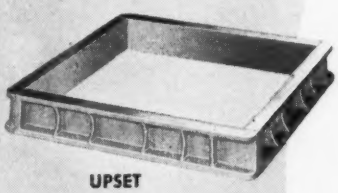

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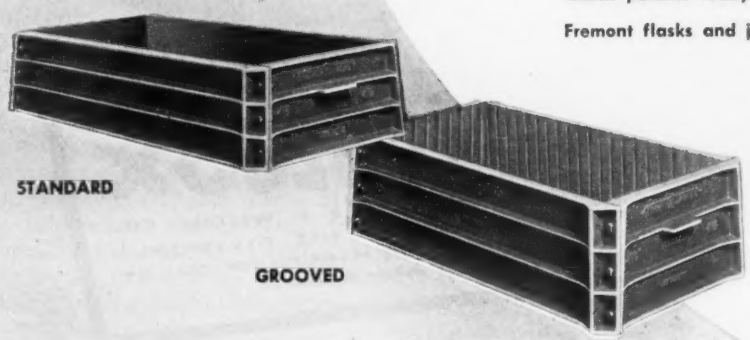

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(*Continued from page* 200)

ville Malleable Iron Co., and Norman Birch, National Bearings Division, American Brake Shoe Co., as co-chairman. The Tetrachords, a quartet led by Jack Hornstein, son of Joseph Hornstein, presented a selection of popular tunes. The coffee talk was by Dr. Herman Offner, dean of Edinboro State Teachers College, whose subject was "Observations on German Life and Conditions as I Saw Them."

Dr. Offner was in Germany for three years following World War II with the army of occupation and the State Department. He said that our country has made a sincere effort to help the German people. However, their world trade which they formerly depended upon was destroyed by the war and it was necessary to start from scratch. The good will we are preaching is taking hold and the German people are beginning to appreciate what we are doing for them. Food is their biggest problem and if a way could be found that they are able to earn more to buy bread, Germany will in a few years be an outstanding ally against the forces of communism.

J. W. Grewell, staff supervisor of industrial relations, Westinghouse Electric Corp., Sharon, Pa., was the principal speaker. His subject, "Human Relations, Our Number One Job," really set the boys on the edge of their chairs. He pointed out that our technicians are leading the world in every kind of development, formulas of every description have been invented. However, people are important and we need better formulas in how to handle them. Management and supervisors must be trained on how to handle men. By carefully analyzing our workers, much good can be done on the human side of life.—*Earl M. Strick, Erie Malleable Iron Co.*

Central Illinois

GUEST speaker at the February meeting of Central Illinois Chapter of the AFS was E. T. Kindt, president, Kindt-Collins Co., Cleveland. In his talk, "Latest Developments in Patternmaking Machinery and Tools," Mr. Kindt emphasized the important part patternmaking plays in the foundry industry. Despite this, he pointed out, the craft has not attained the recognition it deserves. On this continent there is about one patternmaker to every ten thousand people and probably only one person out of one hundred has any knowledge whatsoever of the trade. In addition, Mr. Kindt showed a film on various patternmaker supplies.—*Robert Paluska, Caterpillar Tractor Co.*

WESTERN NEW YORK Chapter of the AFS held its annual stag party at Troop I Post, American Legion, Jan. 19. View of the committee in charge is shown above. Photo by courtesy of A. J. Heysel, E. J. Woodison Co., Buffalo

Northeastern Ohio

BAD weather held attendance down to 108 at the Feb. 8 meeting of Northeastern Ohio Chapter of the AFS at Tudor Arms Hotel, Cleveland. Principal speaker at this meeting, sponsored by the patternmakers division, was Frank J. Oklessen, pattern engineer, Motor Patterns Co., Cleveland. His topic was "Foundry Fixtures and Gages." James Martin, Royal Pattern Works, Cleveland, was technical chairman.

Mr. Oklessen emphasized the importance of gages and fixtures for checking dimensions and quality of cores and dry sand molds. The method is faster and more economical than checking by hand measurement, but any method of checking cores and molds helps to reduce scrap castings.

The speaker exhibited a number of slides showing the use of gages and fixtures in a production foundry manufacturing automotive parts. He described each of the pieces of equipment, suggesting ways of obtaining maximum use from them. He pointed to the practice of chrome plating various parts of dimensional control fixtures to reduce wear on those surfaces in contact with sand. He also warned against use of oil on moving parts of checking equipment; oil accumulates sand and causes excessive wear and inaccuracy in the equipment.

(*Continued on page* 206)

CENTRAL ILLINOIS: Shown at the chapter's Jan. 2 meeting, left to right, are: M. J. Gregory, past national director of the AFS; Scott Roby, Peoria Malleable Castings Co., Peoria, Ill., and Charles Robinson, Excel Brass & Aluminum Foundry, Pekin, Ill. Photo by Fred Brosmer, Caterpillar Tractor Co.

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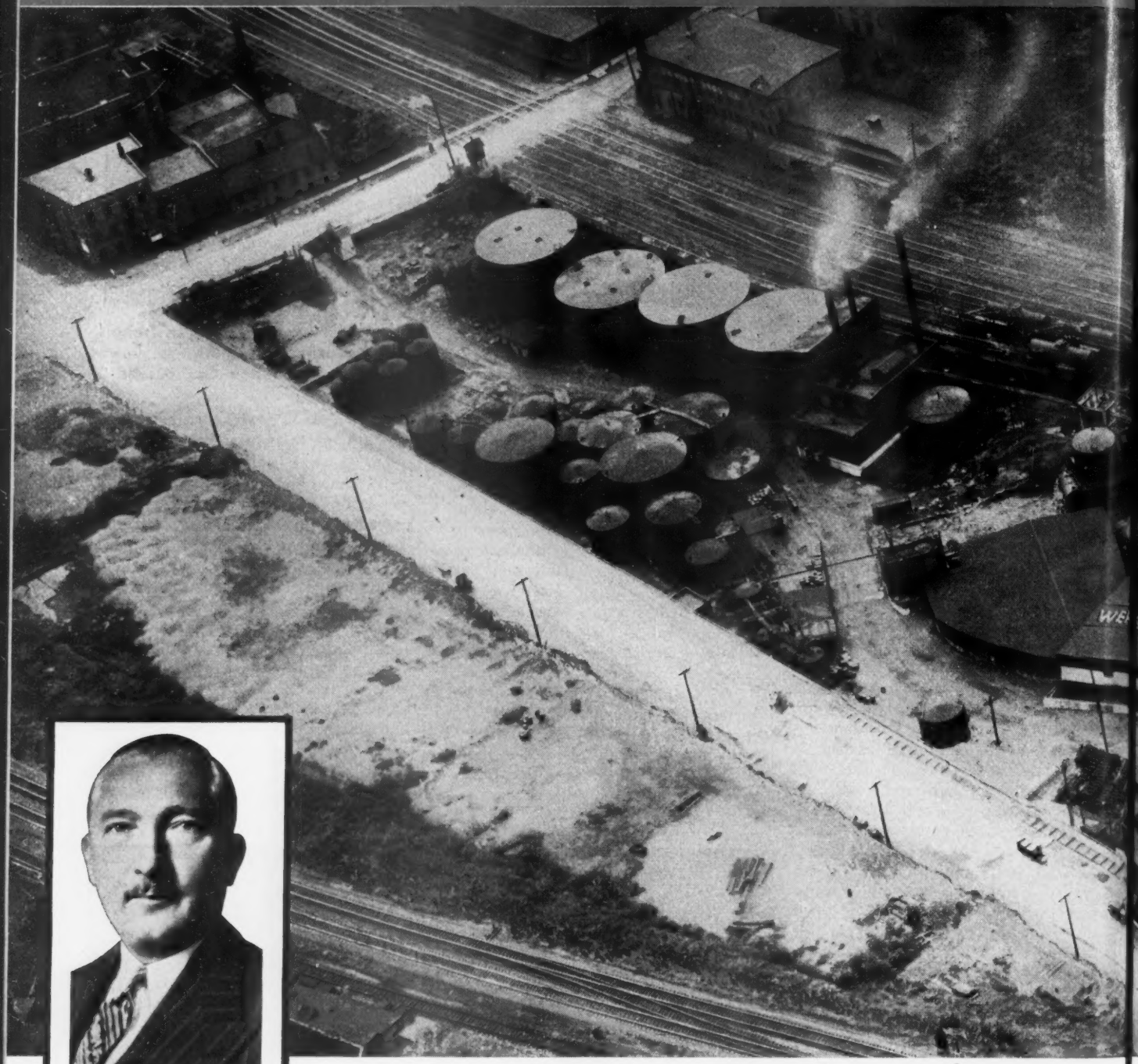

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NG • CLEVELAND 14, OHIO

NORTHEASTERN OHIO Chapter of the AFS held its regular meeting Feb. 8 at Tudor Arms Hotel, Cleveland. Shown at the meeting, left to right, are: Ray Miller, William Marshall, Jack Sutherland, Jack Hill, and Emerson Moon. Mr. Marshall and Mr. Hill of Ley Malleable Castings Co., Derby, England, were visiting in this country. The other men are from Lake City Malleable Inc., Ashtabula, O. Photo by courtesy of Thomas W. Gallagher, Lake City Malleable Co., Cleveland

(*Continued from page* 203)

The coffee talk, "Laughing Is Good Business," was presented by Charles McCune, assistant to the personnel manager, Thompson Products Inc., Cleveland. He pointed out that a sense of humor and a bit of relaxation each day with a laugh or two will help to ease the strain of today's tempo of living.—*Robert H. Herrmann.*

Quad City

TOPIC of the Feb. 19 meeting of Quad-City Chapter of the AFS was "The Modern Foundry, Design, Operation and Maintenance," presented by E. Eugene Ballard, Lester B. Knight & Associates Inc., Chicago.

Mr. Ballard outlined several general plans of mechanization which his company had installed in various foundries. He suggested mechanization as a means of increasing production in comparatively small foundries of limited working or floor area. He stressed the necessity of good housekeeping and the role it plays in good foundry operation. The speaker outlined several methods of obtaining a good materials flow through the foundry and pointed out the economies in labor which may be obtained when all unnecessary handling is eliminated. All equipment should be inspected regularly and be replaced when it is beyond repair. Mr. Ballard warned of the possibility of shortages of equipment during the defense program.—*E. C. Zirzow, Deere & Co.*

CENTRAL INDIANA Chapter of the AFS met on Jan. 8. Shown at the meeting, left to right, are: Robert Spurgin III, Swayn-Robinson Co., Richmond, Ind., chapter chairman; R. L. McIlvaine, National Engineering Co., Chicago, principal speaker, and B. E. Gavin, National Engineering Co., technical chairman

Central Indiana

NATIONAL Officers Night was held by Central Indiana Chapter of the AFS on Feb. 5 at which William W. Maloney, secretary-treasurer; Martin J. O'Brien, a director, and I. R. Wagner, the chapter's first chairman, and now nominee for national vice president of the AFS, were honored guests.

In a short talk, Mr. Maloney gave a picture of what the society is doing. He pointed out the organization is not interested with anything that is not technical and believes all other matters should be handled by the trade associations.

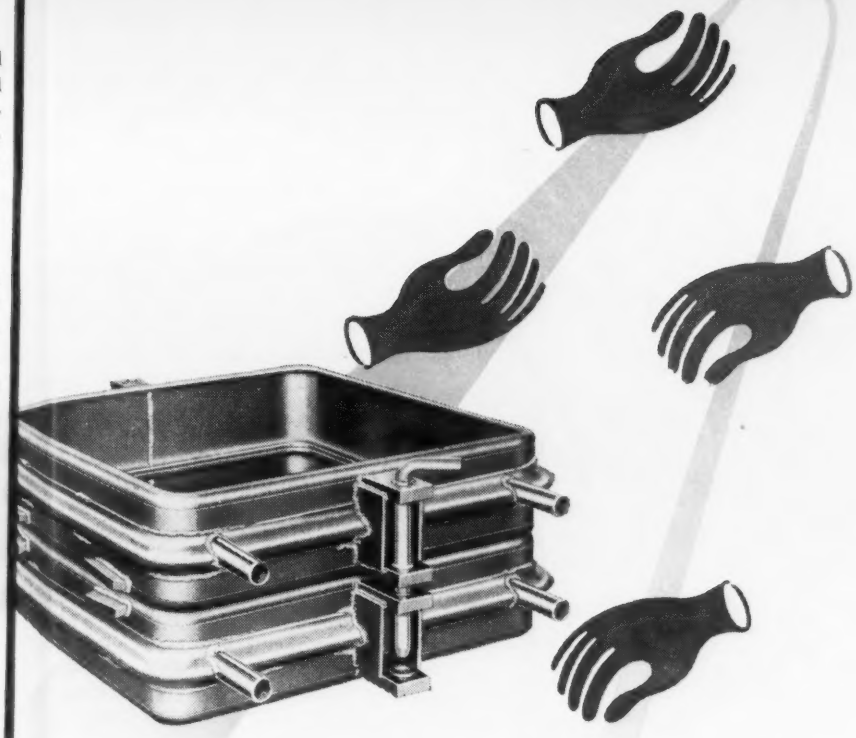
Carl Schopp, foundry manager, Link-Belt Co., Indianapolis, presented two films, "This Moving World," produced by the Malleable Founders' Society; and "What Is Americanism," a cartoon by Harding College.—*Paul V. Faulk, Electric Steel Castings Co.*

New Jersey

FOUNDRYMEN were advised to prepare for a long period of abnormal activity, at the meeting of the New Jersey Foundrymen's Association, Military Park Hotel, Newark, Jan. 22. Robert W. Watt, director of research and public relations, New Jersey Manufacturers Association, Trenton, said that both ferrous and nonferrous foundrymen should look for a period of high activity with accompanying problems of raw material shortages and government controls for months and probably for some years to come, regardless of whether or not the country becomes involved in all-out global warfare. If the United States does not become involved in a major war, he explained there will be a relatively long period of defense preparation, which along with domestic civilian needs, will engage the facilities of most plants.

Mr. Watt said that direct bid requests for defense orders may be obtained by foundrymen by determining the procurement office handling their particular products and by requesting that they be placed on the bid list. He warned that it is important for a foundryman to reply to each bid request received even though he may not care to bid on the particular items listed. He explained it is a policy of the procurement agencies to drop the names of firms who fail to reply to three consecutive

(*Continued on page* 208)



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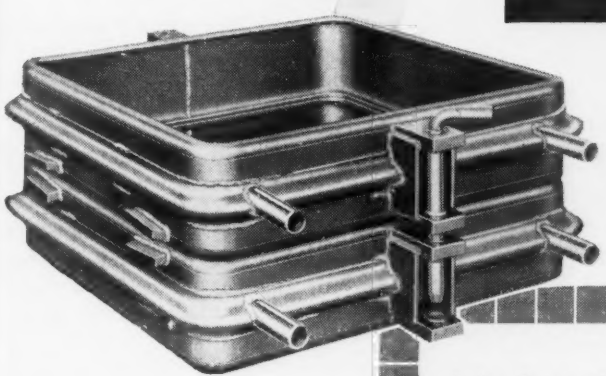

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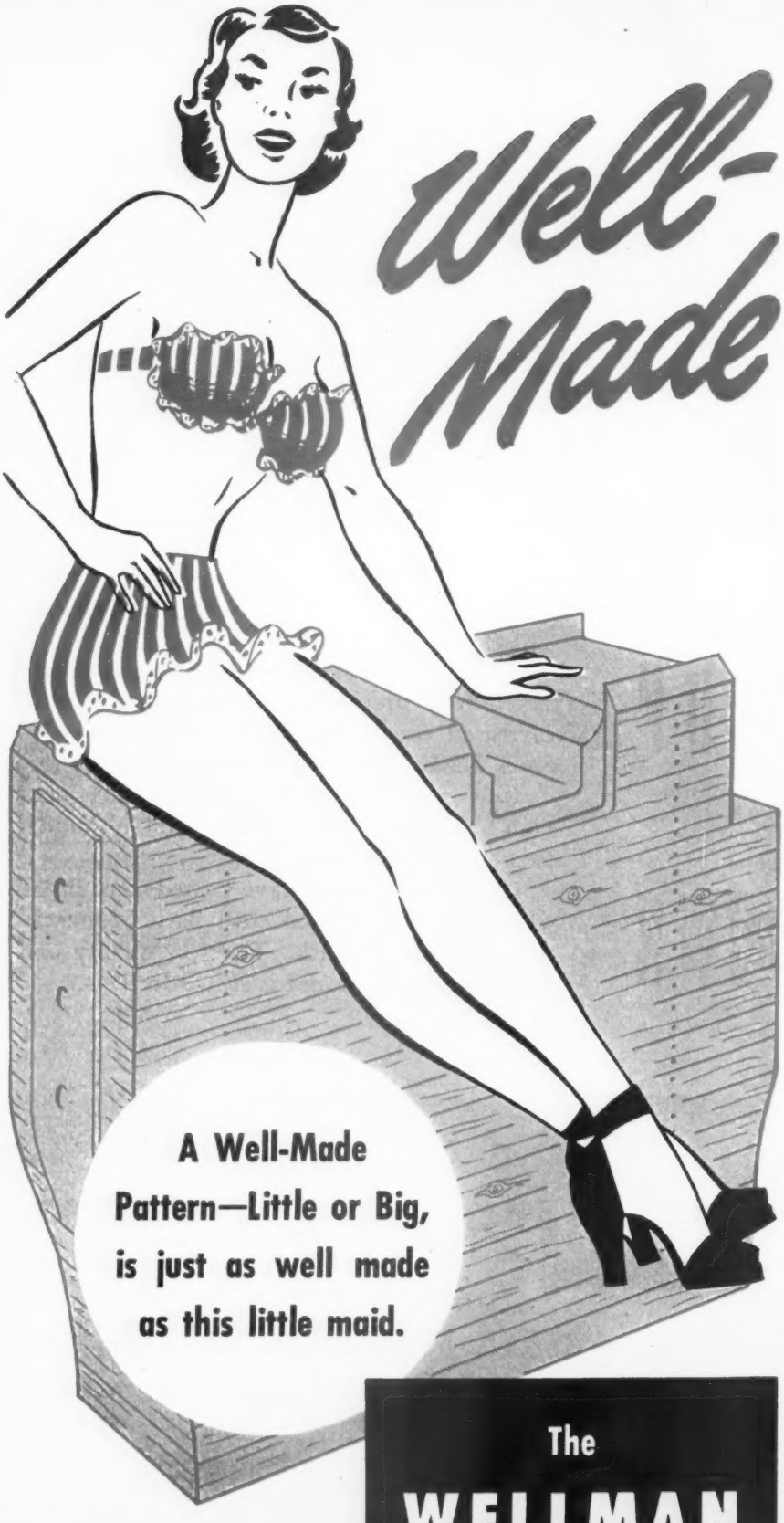

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(*Continued from page* 206)

bid requests. The speaker also commented on various priority regulations and limitation orders, as well as procurement policies.

The association passed a resolution in tribute to the late James A. Williamson, who for more than 20 years was treasurer of the organization and was widely known in New Jersey foundry circles.—*Ben K. Price*

Tennessee

FORTY members and guests were present at the Jan. 26 meeting of Tennessee Chapter of the AFS which was held at the Maxwell House, Nashville. Speaker of the evening was S. C. Massari, technical director of AFS who presented the research film, "Fluid Flow in Transparent Molds," which has been produced under the auspices of the society's Aluminum and Magnesium Division.—*Carl Fischer Jr., Fischer Supply Co.*

Washington

MECHANIZING the Small Foundry" was discussed by Russell J. Geitman, foundry engineer with Link-Belt Co. at the January meeting of Washington Chapter of the AFS held at the Gowman hotel, Seattle.

Materials handling is a major problem in the foundry since approximately 150 to 200 tons of material are handled for each ton of good castings produced. Mr. Geitman listed the following reasons for mechanization: Lower unit cost; increased production; conservation of manpower and space; and improved working conditions.

Each small foundry presents a different problem when mechanization is considered and requires individual study of the nature of its product and the tonnage output. The speaker advised a carefully considered overall plan for step by step mechanization to suit the needs of the individual foundry. The small jobbing foundryman cannot control the type of work in his foundry. Therefore, he must consider flexibility of any mechanized aids to production which he plans to install. His first problem is to relieve the molder of manual labor thereby increasing his effective molding effort. Any plan for mechanization must be based on an analysis of the flow of material through the foundry—the ideal plan being a straight line flow from raw materials to the final product.

With these points in mind, start with individual units that will fit your needs now and later on may be incorporated in the overall plan for

(*Concluded on page* 210)

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(*Concluded from page* 208)

straightline flow mechanization of materials handling, molding, melting, pouring and cleaning operations. Mr. Geitman showed slides to illustrate how mechanized equipment can be used in foundries of various sizes.—*Edward D. Boyle, Puget Sound Naval Shipyard*

Pittsburgh

REGULAR meeting of the Pittsburgh Foundrymen's Association, held Feb. 19 at the Fort Pitt Hotel, had as its principal speaker Warner B. Bishop, manager of foundry sales, Archer-Daniels-Midland Co., Cleveland.

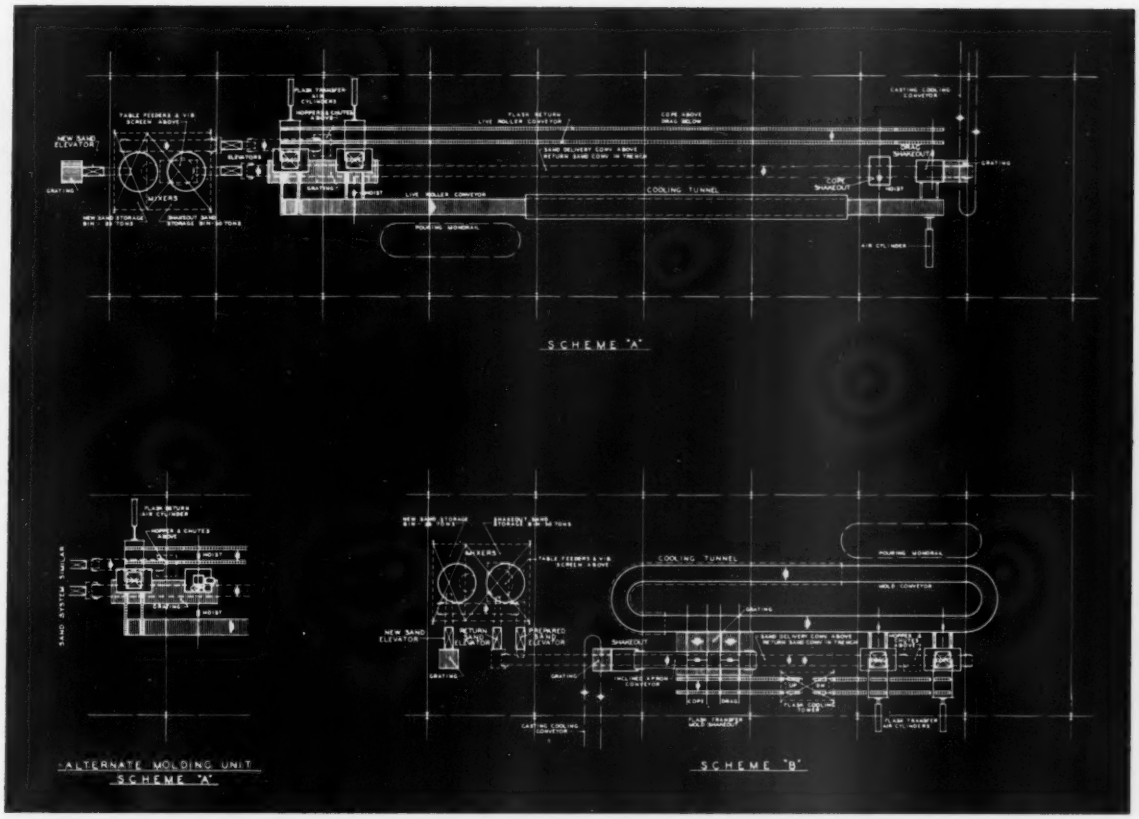
Mr. Bishop stated that of the variety of binders used in foundry cores today, 95 per cent are divided among four materials: Cereal, core oil, synthetic resins and water.

Cereal is used primarily for green bond. Its secondary contribution is baked strength. Its great advantage is that it adds green bond with no detrimental influence upon baked strength; in fact, it augments baked strength. The difficulty in using cereal is to measure accurately the amount to be added since its reaction with varying amounts of water is critical. For example, in lake sand, cereal produces its best green bond in a water-cereal ratio of 2:1. The paradox is that it produces the best baked strength at a water-cereal ratio of 4:1. Optimum baked strength and green bond cannot be produced at the same water level, therefore a compromise is always involved. Cereal is fast baking and produces best strengths at 300-350° F.

The outstanding advantages of core oil are in its versatility, stability, ease of handling and lubricity. Core oil does reduce green bond of a sand-cereal-water mixture slightly. The outstanding disadvantage of traditional core oil lies in the fact that there is a limit on how fast it can be baked.

Although resins have been available to foundrymen since World War I, the current increased interest in them can be attributed to today's high production rates which make shortage of oven capacity critical in many foundries. Urea and phenol formaldehyde resins are thermosetting and do offer a fast bake.

Water costs practically nothing, but therein lies one of its disadvantages. In fact, the moisture level of a core sand mixture containing cereal influences the properties of that mixture severely. At critical moisture levels, the variation of as little as 1 per cent moisture can vary green or baked properties by nearly 50 per cent.—*J. C. Sullivan*



COMPARATIVE STUDIES

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Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.
1	.03937	51	2.00787	101	3.97637	151	5.94487	201	7.91337	251	9.88187	301	11.85037	351	13.81887	401	15.78737	451	17.75587
2	.07874	52	2.04724	102	4.01574	152	5.98424	202	7.95274	252	9.92124	302	11.88974	352	13.85824	402	15.82674	452	17.79524
3	.11811	53	2.08661	103	4.05511	153	6.02361	203	7.99211	253	9.96061	303	11.92911	353	13.89761	403	15.86611	453	17.83461
4	.15748	54	2.12598	104	4.09448	154	6.06298	204	8.03148	254	9.99998	304	11.96848	354	13.93698	404	15.90548	454	17.87398
5	.19685	55	2.16535	105	4.13385	155	6.10235	205	8.07085	255	10.03935	305	12.00785	355	13.97635	405	15.94485	455	17.91335
6	.23622	56	2.20472	106	4.17322	156	6.14172	206	8.11022	256	10.07872	306	12.04722	356	14.01572	406	15.98422	456	17.95272
7	.27559	57	2.24409	107	4.21259	157	6.18109	207	8.14959	257	10.11809	307	12.08659	357	14.05509	407	16.02359	457	17.99209
8	.31496	58	2.28346	108	4.25196	158	6.22046	208	8.18896	258	10.15746	308	12.12596	358	14.09446	408	16.06296	458	18.03146
9	.35433	59	2.32283	109	4.29133	159	6.25983	209	8.22833	259	10.19683	309	12.16533	359	14.13383	409	16.10233	459	18.07383
10	.39370	60	2.36220	110	4.33070	160	6.29920	210	8.26770	260	10.23620	310	12.20470	360	14.17320	410	16.14170	460	18.11020
11	.43307	61	2.40157	111	4.37007	161	6.33857	211	8.30707	261	10.27557	311	12.24407	361	14.21257	411	16.18107	461	18.14957
12	.47244	62	2.44094	112	4.40944	162	6.37794	212	8.34644	262	10.31494	312	12.28344	362	14.25194	412	16.22044	462	18.18894
13	.51181	63	2.48031	113	4.44881	163	6.41731	213	8.38581	263	10.35431	313	12.32281	363	14.29131	413	16.25981	463	18.22821
14	.55118	64	2.51968	114	4.48818	164	6.45668	214	8.42518	264	10.39368	314	12.36218	364	14.33068	414	16.29918	464	18.26768
15	.59055	65	2.55905	115	4.52755	165	6.49605	215	8.46455	265	10.43305	315	12.40155	365	14.37005	415	16.33855	465	18.30705
16	.62992	66	2.59842	116	4.56692	166	6.53542	216	8.50392	266	10.47242	316	12.44092	366	14.40942	416	16.37792	466	18.34642
17	.66929	67	2.63779	117	4.60629	167	6.57479	217	8.54329	267	10.51179	317	12.48029	367	14.44879	417	16.41729	467	18.38579
18	.70866	68	2.67716	118	4.64566	168	6.61416	218	8.58266	268	10.55116	318	12.51966	368	14.48816	418	16.45666	468	18.42516
19	.74803	69	2.71653	119	4.68503	169	6.65353	219	8.62203	269	10.59053	319	12.55903	369	14.52753	419	16.49603	469	18.46453
20	.78740	70	2.75590	120	4.72440	170	6.69290	220	8.66140	270	10.62990	320	12.59840	370	14.56690	420	16.53540	470	18.50390
21	.82677	71	2.79527	121	4.76377	171	6.73227	221	8.70077	271	10.66927	321	12.63777	371	14.60627	421	16.57477	471	18.54327
22	.86614	72	2.83464	122	4.80314	172	6.77164	222	8.74014	272	10.70864	322	12.67714	372	14.64564	422	16.61414	472	18.58264
23	.90551	73	2.87401	123	4.84251	173	6.81101	223	8.77951	273	10.74801	323	12.71651	373	14.68501	423	16.65351	473	18.62201
24	.94488	74	2.91338	124	4.88188	174	6.85038	224	8.81888	274	10.78738	324	12.75588	374	14.72438	424	16.69288	474	18.66138
25	.98425	75	2.95275	125	4.92125	175	6.88975	225	8.85825	275	10.82675	325	12.79525	375	14.76375	425	16.73225	475	18.70075
26	1.02362	76	2.99212	126	4.96062	176	6.92912	226	8.89762	276	10.86612	326	12.83462	376	14.80312	426	16.77162	476	18.74012
27	1.06299	77	3.03149	127	4.99999	177	6.96849	227	8.93699	277	10.90549	327	12.87399	377	14.84249	427	16.81099	477	18.77949
28	1.10236	78	3.07086	128	5.03936	178	7.00786	228	8.97636	278	10.94486	328	12.91336	378	14.88186	428	16.85036	478	18.81886
29	1.14173	79	3.11023	129	5.07873	179	7.04723	229	9.01573	279	10.98423	329	12.95273	379	14.92123	429	16.88973	479	18.85823
30	1.18110	80	3.14960	130	5.11810	180	7.08660	230	9.05510	280	11.02360	330	12.99210	380	14.96060	430	16.92910	480	18.89760
31	1.22047	81	3.18897	131	5.15747	181	7.12597	231	9.09447	281	11.06297	331	13.03147	381	14.99997	431	16.96847	481	18.93697
32	1.25984	82	3.22834	132	5.19684	182	7.16534	232	9.13384	282	11.10234	332	13.07084	382	15.03934	432	17.00784	482	18.97634
33	1.29921	83	3.26771	133	5.23621	183	7.20471	233	9.17321	283	11.14171	333	13.11021	383	15.07871	433	17.04721	483	19.01571
34	1.33858	84	3.30708	134	5.27558	184	7.24408	234	9.21258	284	11.18108	334	13.14958	384	15.11808	434	17.08658	484	19.05508
35	1.37795	85	3.34645	135	5.31495	185	7.28345	235	9.25195	285	11.22045	335	13.18895	385	15.15745	435	17.12595	485	19.09445
36	1.41732	86	3.38582	136	5.35432	186	7.32282	236	9.29132	286	11.25982	336	13.22832	386	15.19682	436	17.16532	486	19.13382
37	1.45669	87	3.42519	137	5.39369	187	7.36219	237	9.33069	287	11.29919	337	13.26769	387	15.23619	437	17.20469	487	19.17319
38	1.49606	88	3.46456	138	5.43306	188	7.40156	238	9.37006	288	11.33856	338	13.30706	388	15.27556	438	17.24406	488	19.21256
39	1.53543	89	3.50393	139	5.47243	189	7.44093	239	9.40943	289	11.37793	339	13.34643	389	15.31493	439	17.28343	489	19.25193
40	1.57480	90	3.54330	140	5.51180	190	7.48030	240	9.44880	290	11.41730	340	13.38580	390	15.35430	440	17.32280	490	19.29130
41	1.61417	91	3.58267	141	5.55117	191	7.51967	241	9.48817	291	11.45667	341	13.42517	391	15.39367	441	17.36217	491	19.33067
42	1.65354	92	3.62204	142	5.59054	192	7.55904	242	9.52754	292	11.49604	342	13.46454	392	15.43304	442	17.40154	492	19.37004
43	1.69291	93	3.66141	143	5.62991	193	7.59841	243	9.56691	293	11.53541	343	13.50391	393	15.47241	443	17.44091	493	19.40941
44	1.73228	94	3.70078	144	5.66928	194	7.63778	244	9.60628	294	11.57478	344	13.54328	394	15.51178	444	17.48028	494	19.44878
45	1.77165	95	3.74015	145	5.70865	195	7.67715	245	9.64565	295	11.61415	355	13.58265	395	15.55115	445	17.51965	495	19.48815
46	1.81102	96	3.77952	146	5.74802	196	7.71652	246	9.68502	296	11.65352	346	13.62202	396	15.59052	446	17.55902	496	19.52752
47	1.85039	97	3.81889	147	5.78739	197	7.75589	247	9.72439	297	11.69289	347	13.66139	397	15.62989	447	17.59839	497	19.56689
48	1.88976	98	3.85826	148	5.82676	198	7.79526	248	9.76376	298	11.73226	348	13.70076	398	15.66926	448	17.63776	498	19.60626
49	1.92913	99	3.89763	149	5.86613	199	7.83463	249	9.80313	299	11.77163	349	13.74013	399	15.70863	449	17.67713	499	19.64563
50	1.96850	100	3.93700	150	5.90550	200	7.87400	250	9.84259	300	11.81100	350	13.77950	400	15.74800	450	17.71650	500	19.68500

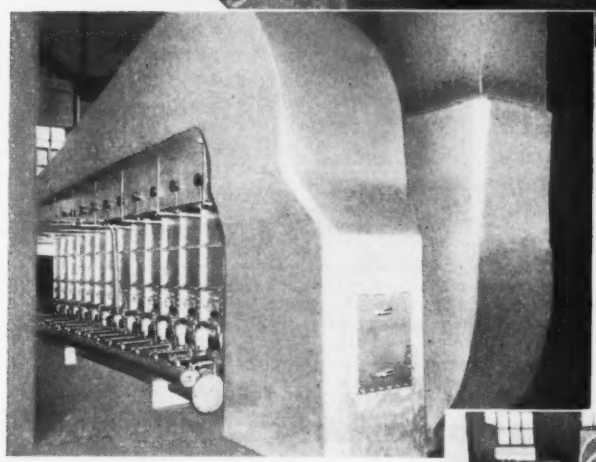
TABLE CONVERTING 1 TO 1000 MILLIMETERS TO INCHES

Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.
501	19.72437	551	21.69287	601	23.66137	651	25.62987	701	27.59837	751	29.56687	801	31.53537	851	33.50387	901	35.47237	951	37.44087
502	19.76374	552	21.73224	602	23.70074	652	25.66924	702	27.63774	752	29.60624	802	31.57474	852	33.54324	902	35.51174	952	37.48024
503	19.80311	553	21.77161	603	23.74011	653	25.70861	703	27.67711	753	29.64561	803	31.61411	853	33.58261	903	35.55111	953	37.51961
504	19.84248	554	21.81098	604	23.77948	654	25.74798	704	27.71648	754	29.68498	804	31.65348	854	33.62198	904	35.59048	954	37.55898
505	19.88185	555	21.85035	605	23.81885	655	25.78735	705	27.75585	755	29.72435	805	31.69285	855	33.66135	905	35.62985	955	37.59835
506	19.92122	556	21.88972	606	23.85822	656	25.82672	706	27.79522	756	29.76372	806	31.73222	856	33.70072	906	35.66922	956	37.63772
507	19.96059	557	21.92909	607	23.89759	657	25.86609	707	27.83459	757	29.80309	807	31.77159	857	33.74009	907	35.70859	957	37.67709
508	19.99996	558	21.96846	608	23.93696	658	25.90546	708	27.87396	758	29.84246	808	31.81096	858	33.77946	908	35.74796	958	37.71646
509	20.03933	559	22.00783	609	23.97633	659	25.94483	709	27.91333	759	29.88183	809	31.85033	859	33.81883	909	35.78733	959	37.75583
510	20.07870	560	22.04720	610	24.01570	660	25.98420	710	27.95270	760	29.92120	810	31.88970	860	33.85820	910	35.82670	960	37.79520
511	20.11807	561	22.08657	611	24.05507	661	26.02357	711	27.99207	761	29.96057	811	31.92907	861	33.89757	911	35.86607	961	37.83457
512	20.15744	562	22.12594	612	24.09444	662	26.06294	712	28.03144	762	29.99994	812	31.96844	862	33.93694	912	35.90544	962	37.87394
513	20.19681	563	22.16531	613	24.13381	663	26.10231	713	28.07081	763	30.03931	813	32.00781	863	33.97631	913	35.94481	963	37.91331
514	20.23618	564	22.20468	614	24.17318	664	26.14168	714	28.11018	764	30.07868	814	32.04718	854	34.01568	914	35.98418	964	37.95268
515	20.27555	565	22.24405	615	24.21255	655	26.18105	715	28.14955	765	30.11805	815	32.08655	865	34.05505	915	36.02355	965	37.99205
516	20.31492	566	22.28342	616	24.25192	666	26.22042	716	28.18892	766	30.15742	816	32.12592	866	34.09442	916	36.06292	966	38.03142
517	20.35429	567	22.32279	617	24.29129	667	26.25979	717	28.22829	767	30.19679	817	32.16529	867	34.13379	917	36.10229	967	38.07079
518	20.39366	568	22.36216	618	24.33066	668	26.29916	718	28.26766	768	30.23616	818	32.20466	868	34.17316	918	36.14166	968	38.11016
519	20.43303	569	22.40153	619	24.37003	669	26.33853	719	28.30703	769	30.27553	819	32.24403	869	34.21253	919	36.18103	969	38.14953
520	20.47240	570	22.44090	620	24.40940	670	26.37790	720	28.34640	770	30.31490	820	32.28340	870	34.25190	920	36.22040	970	38.18890
521	20.51177	571	22.48027	621	24.44877	671	26.41727	721	28.38577	771	30.35427	821	32.32277	871	34.29127	921	36.25977	971	38.22827
522	20.55114	572	22.51964	622	24.48814	672	26.45664	722	28.42514	772	30.39364	822	32.36214	872	34.33064	922	36.29914	972	38.26764
523	20.59051	573	22.55901	623	24.52751	673	26.49601	723	28.46451	773	30.43301	823	32.40151	873	34.37001	923	36.33851	973	38.30701
524	20.62988	574	22.59838	624	24.56688	674	26.53538	724	28.50388	774	30.47238	824	32.44088	874	34.40938	924	36.37788	974	38.34638
525	20.66925	575	22.63775	625	24.60625	675	26.57475	725	28.54325	775	80.51175	825	32.48025	875	34.44875	925	36.41725	975	38.38575
523	20.70862	576	22.67712	626	24.64562	676	26.61412	726	28.58262	776	30.55112	826	32.51962	876	34.48812	926	36.45662	976	38.42512
527	20.74799	577	22.71649	627	24.68499	677	26.65349	727	28.62199	777	30.59049	827	32.55899	877	34.52749	927	36.49599	977	38.46449
528	20.78736	578	22.75586	628	24.72436	678	26.69286	728	28.66136	778	30.62986	828	32.59836	878	34.56686	928	36.53536	978	38.50386
529	20.82673	579	22.79523	629	24.76373	679	26.73223	729	28.70073	779	30.66923	829	32.63773	879	34.60623	929	36.57473	979	38.54323
530	20.86610	580	22.83460	630	24.80310	680	26.77160	730	28.74010	780	30.70860	830	32.67710	880	34.64560	930	36.61410	980	38.58260
531	20.90547	581	22.87397	631	24.84247	681	26.81097	731	28.77947	781	30.74797	831	32.71647	881	34.68497	931	36.65347	981	38.62197
532	20.94484	582	22.91334	632	24.88184	682	26.85034	732	28.81884	782	30.78734	832	32.75584	882	34.72434	932	36.69284	982	38.66134
533	20.98421	583	22.95271	633	24.92121	683	26.88971	733	28.85821	783	30.82671	833	32.79521	883	34.76371	933	36.73221	983	38.70071
534	21.02358	584	22.99208	634	24.96058	684	26.92908	734	28.89758	784	30.86608	834	32.83458	884	34.80308	934	36.77158	984	38.74008
535	21.06295	585	23.03145	635	24.99995	685	26.96845	735	28.93695	785	30.90545	835	32.87395	885	34.84245	935	36.81095	985	38.77945
536	21.10232	586	23.07082	636	25.03932	686	27.00782	736	28.97632	786	30.94482	836	32.91332	886	34.88182	936	36.85032	986	38.81882
537	21.14169	587	23.11019	637	25.07869	687	27.04719	737	29.01569	787	30.98419	837	32.95269	887	34.92119	937	36.88969	987	38.85819
538	21.18106	588	23.14956	638	25.11806	688	27.08656	738	29.05506	788	31.02356	838	32.99206	888	34.96056	938	36.92906	988	38.89756
539	21.22043	589	23.18893	639	25.15743	689	27.12593	739	29.09443	789	31.06293	839	33.03143	889	34.99993	939	36.96843	989	38.93693
540	21.25980	590	23.22830	640	25.19380	690	27.16530	740	29.13380	790	31.10230	840	33.07080	890	35.03930	940	37.00780	990	38.97630
541	21.29917	591	23.26767	641	25.23617	691	27.20467	741	29.17317	791	31.14167	841	33.11017	891	35.07867	941	37.04717	991	39.01567
542	21.33854	592	23.30704	642	25.27554	692	27.24404	742	29.21254	792	31.18104	842	33.14954	892	35.11804	942	37.08654	992	39.05504
543	21.37791	593	23.34641	643	25.31491	693	27.28341	743	29.25191	793	31.22041	843	33.18891	893	35.15741	943	37.12591	993	39.09441
544	21.41728	594	23.38578	644	25.35428	694	27.32278	744	29.29128	794	31.25978	844	33.22828	894	35.19678	944	37.16528	994	39.13378
545	21.45665	595	23.42515	645	25.39365	695	27.36215	745	29.33068	795	31.29915	845	33.26765	895	35.23615	945	37.20465	995	39.17315
546	21.49602	596	23.46452	646	25.43302	696	27.40152	746	29.37002	793	31.33852	846	33.30702	896	35.27552	946	37.24402	996	39.21252
547	21.53539	597	23.50389	647	25.47239	697	27.44089	747	29.40939	797	31.37789	847	33.34639	897	35.31489	947	37.28339	997	39.25189
548	21.57476	598	23.54326	648	25.51176	698	27.48026	748	29.44876	798	31.41726	848	33.38576	898	35.35426	948	37.32276	998	39.29126
549	21.61413	599	23.58263	649	25.55113	699	27.51963	749	29.48813	799	31.45663	849	33.42513	899	35.39363	949	37.36213	999	39.33063
550	21.65350	600	23.62200	650	25.59050	700	27.55900	750	29.52750	800	31.49600	850	33.46450	900	35.43300	950	37.40150	1,000	39.37000

Get More TONNAGE

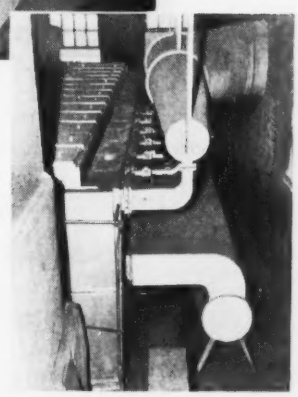
IN A LARGE EASTERN FOUNDRY

9 Extra tons per hour



WERE SECURED WITH THE MODERN

ROSS HOT BLAST Heating System



At no time has the need for increased output been greater. And the most effective means for increasing tonnage is through more efficient cupola heating by the modern ROSS HOT BLAST SYSTEM. Without any interference to your melting schedule you can install the ROSS system to operate with your present blowers. It will raise the temperature of the air going to your cupola to 450 deg. F., give you quicker start-up and increase your melt by *many extra tons per hour*. With the sizable savings it effects in coke, labor and maintenance materials, the system will pay for itself in surprisingly short time. Any plant operating 2 or more cupolas can profit handsomely from this simple, effective and economical heating system.

Top—Increased tonnage from the same cupola.

Center—Ross Air Heater bank showing gas burners, safety controls—also combustion header and exhaust fan.

Above—Rear of heater bank; cold and hot air headers with damper and temperature controls.

Your nearest ROSS office can give you full information concerning this Hot Blast System for your particular operating conditions.

ROSS SYSTEMS

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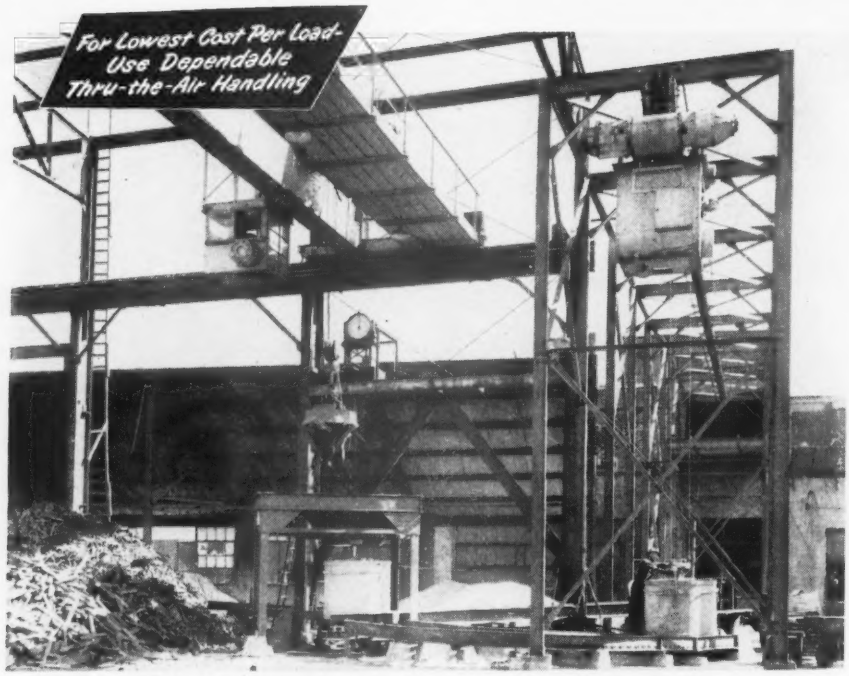
ROSS ENGINEERING OF CANADA, LIMITED, MONTREAL 32, CANADA • CARRIER-ROSS ENGINEERING COMPANY, LIMITED, LONDON, ENGLAND



Shepard Niles weather-proofed, double-monorail cupola charger, teams up with a 5-ton Shepard Niles weather-proofed, magnet-handling crane and Shepard Niles bottom-dump cupola buckets to speed operations and reduce handling costs at a large mid-western foundry. Notice that crane operator has unobstructed view of scale, assuring accurate control of proper amounts of pig and scrap iron.

we start by asking "what"

WHAT are *your* problems? Under WHAT conditions will *your* crane or monorail hoist be operated—intermittently, or under fairly constant conditions? WHAT are the operating speeds necessary to meet *your* productive cycle?

Answers to these and similar questions made it possible for Shepard Niles to provide efficient, dependable service, plus extremely low maintenance costs—giving this mid-western foundry the lowest handling cost per load for years to come.

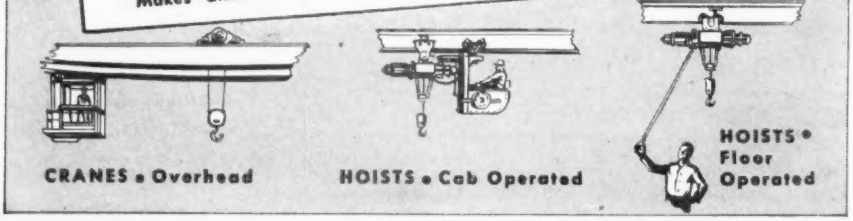
Be sure you get the equipment best qualified to do *your* job. It's wise—and costs you nothing—to get the facts first, rather than to make expensive changes later.

May we place our experience of a great many years of successfully designing all types of crane installations at your disposal?

Shepard Niles

CRANE & HOIST CORPORATION

Makes and sells all three lifting tools for airborne shop loads



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OBITUARY

WILLIAM H. Seaman, 64, board chairman and president, National Roll & Foundry Co., Avonmore, Pa., died Feb. 13. Mr. Seaman entered the roll industry with Seaman-Sleeth Co., later Pittsburgh Rolls Corp. In 1924 he was appointed vice president, Hubbard Steel Foundry Co., Chicago, and when in 1930 it was acquired by Continental Roll & Steel Foundry Co., he became vice president of that company. He joined Mesta Machine Co., Pittsburgh, in 1935 as vice president, and resigned in 1941 to head National Roll & Foundry Co.

* * *

Jack Jacobson, 61, president, Union Malleable Mfg. Co., Ashland, O., died recently. Mr. Jacobson, a native of Lithuania, went to Cleveland when he was 8 years of age. He organized Union Malleable Mfg. Co. in 1922 and was also president of its subsidiaries, Ashland Malleable Iron Co. and Union Brass & Copper Co., Ashland, O.

* * *

Robert C. Stanley, 74, chairman of the board of directors and former president, International Nickel Co. of Canada Ltd., died Feb. 12. Mr. Stanley had been associated with the company since 1901 and in 1918 became vice president in charge of operations. He was made president in 1922 and chairman in 1949.

* * *

Russell L. Peck, refractories engineer, Norton Co., Worcester, Mass., was killed Jan. 23 in an automobile accident in Tallulah, La., while on a business trip. Mr. Peck, who joined the company in 1945, also covered the territory in and around Philadelphia.

* * *

Edwin Mudie, 68, formerly supervisor with the pattern and foundry division, Ford Motor Co., Dearborn, Mich., died Feb. 21 in St. Petersburg, Fla., where he had lived since his retirement two years ago. He was a native of Dundee, Scotland.

* * *

Ford C. Richey, 55, assistant sales manager, Republic Coal & Coke Co., Chicago, died Mar. 9, following a heart attack en route to his office.

* * *

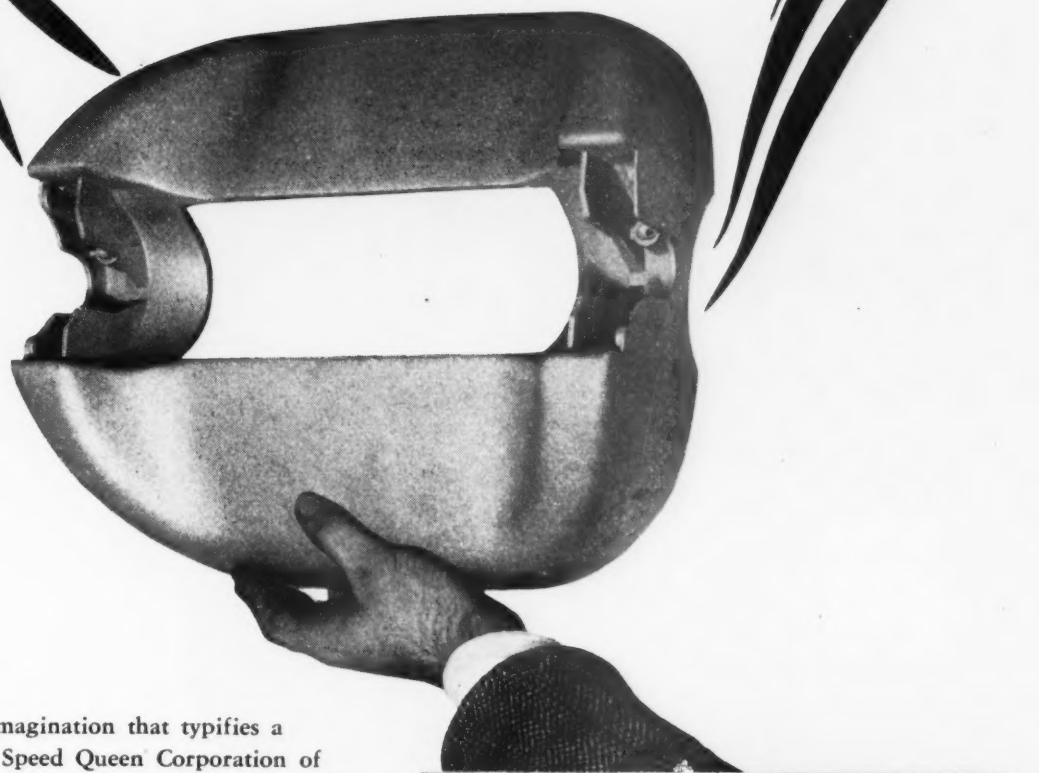
William C. Ellis II, 45, general superintendent, Kingsport Foundry & Mfg. Corp., Kingsport, Tenn., died Feb. 26.

* * *

M. W. Perry, 87, founder, Algoma Foundry & Machine Co., Algoma, Wis., died Feb. 18, in West Palm

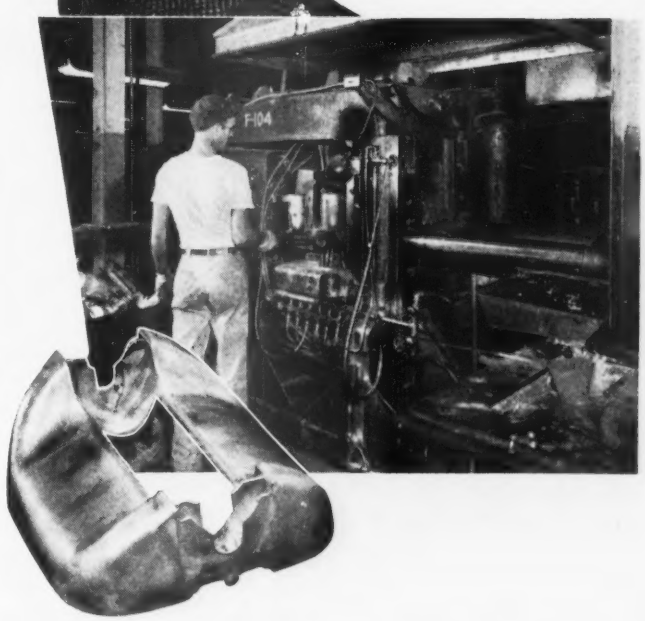
(*Concluded on page* 218)

a bird in hand...



With the foresight and imagination that typifies a progressive company, Speed Queen Corporation of Ripon, Wisconsin, made a careful survey of die casting—*and decided to bring the operation under their own roof—using Lester-Phoenix Die Casting Machines!*

Here's a case where a company with no previous experience used the economy and efficiency of the Lesters to assure them of successful results. Starting with a battery of six Lester-Phoenix Machines, Speed Queen was soon able to say, "... as to rate of production, we are as good if not better than the average field picture and our quality is excellent." Lester-Phoenix service and engineering personnel will be pleased to help you, too, set up a successful die casting installation in your plant.



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GRINDING
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(*Concluded from page* 216)

Beach, Fla. A native of Racine, Wis., Mr. Perry had lived in Algoma from boyhood and took an active part in the industrial and political life there.

* * *

W. C. McMahon, 87, formerly vice president and general manager of the Columbia Malleable Castings Corp., Columbia, Pa., died Feb. 18 in Milwaukee. He retired from active business in 1946.

* * *

Earl L. Kremer, for a number of years connected in a managerial capacity with Lake City Malleable Co., Cleveland, and recently advertising manager of that company, died Feb. 9.

* * *

John Hyndes, managing director, Metters Ltd., Sydney, Australia, died recently. Mr. Hyndes visited many foundries in the United States, two years ago, on his return from a trip to Scotland.

* * *

Joseph Schwab, foundry superintendent, Skinner Engine Co., Erie, Pa., died recently. Mr. Schwab was a charter member of the Northwestern Pennsylvania Chapter of the AFS.

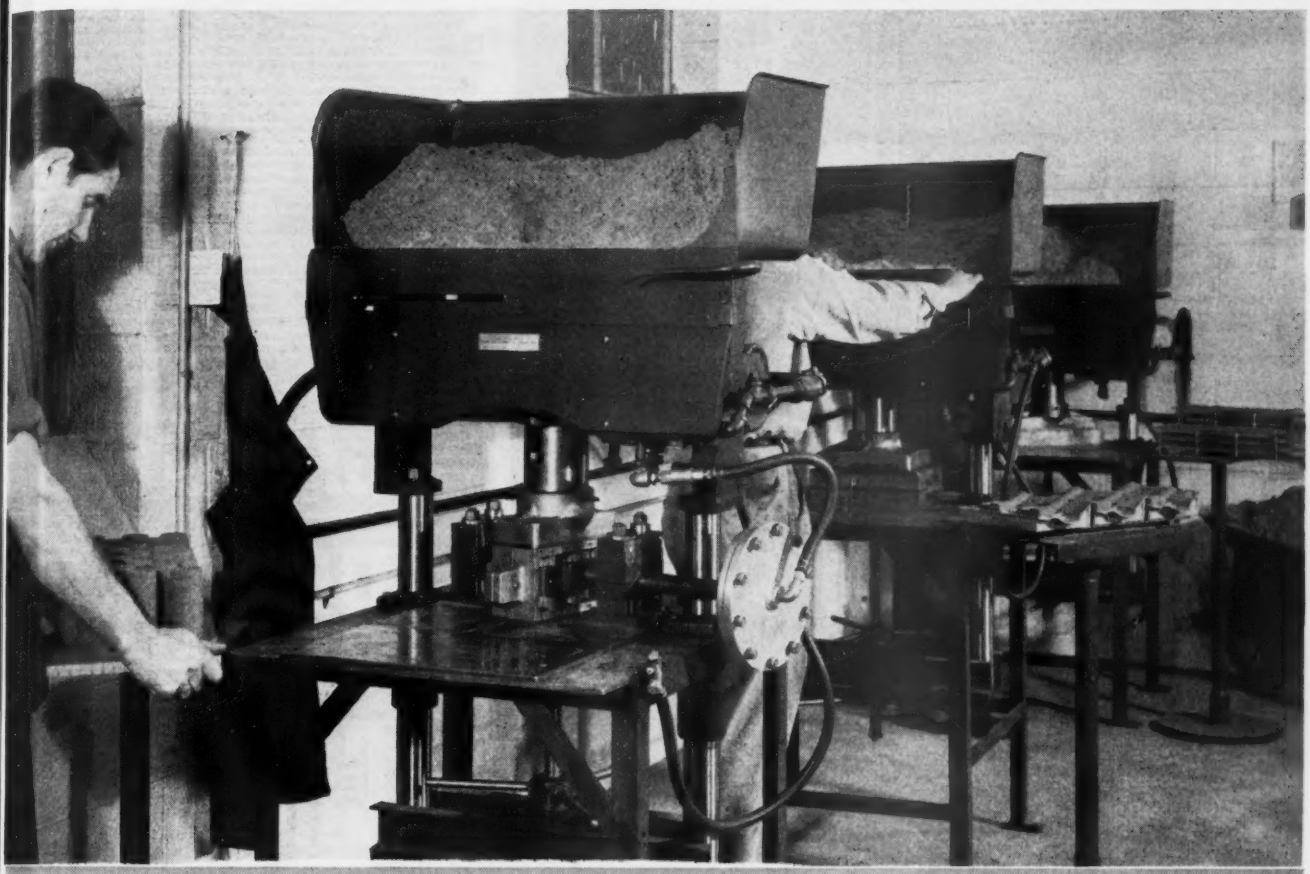
* * *

Walter L. Baumbach, 70, for the past 15 years sales representative, Delta Oil Products Co., Milwaukee, died Feb. 9 at his home there, following a long illness.

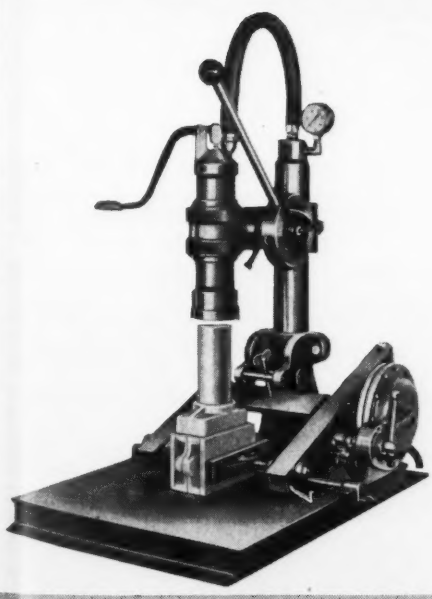
Book Review

Transactions of The American Foundrymen's Society; Vol. 58; 1950; 760 pages 8 x 11 in.; fabricoid cover; published by the American Foundrymen's Society, 616 S. Michigan Ave., Chicago. Price to members $8, to nonmembers $15.

The present volume is 58th in a series extending back to the formation of the society or, as it was known for many years, the association, in 1896. Change in size and general appearance over the years bears silent testimony to the growth and activities of the society. Page size, 8 x 11 in., was adopted in Vol. 53, in 1945. The present volume contains a summary of proceedings of the 54th annual meeting; president's annual address; reports of officers; financial statements; membership reports; minutes of board meetings; seventh annual chapter officers conference. The greater part of the book from page 1 to page 751 is devoted to the 77 technical papers and discussions presented at the AFS convention in Cleveland May 8-12, 1950. The book concludes with a seven-page subject and author index.



REDFORD *No. 2 Stationary Magazine Type* CORE BLOWER



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Foundry STATISTICS

Malleable Iron

(Shipments of castings—net tons[1])

	Shipments		Unfilled
	Total	For Sale	Orders[2]
1948	933,265	525,212	.....
1949			
Dec.	57,379	29,679	60,835
Total	713,330	371,214	.....
1950			
Jan.	62,874	32,918	62,307
Feb.	60,386	31,249	67,049
Mar.	66,259	38,639	69,866
Apr.	69,822	36,279	76,250
May	76,161	42,432	77,074
June	82,345	46,613	86,783
July	67,514	37,198	105,300
Aug.	86,021	50,019	132,374
Sept.	82,479	46,927	152,583
Oct.	89,968	50,157	160,278
Nov.	85,163	48,670	180,099
Dec.	91,510	51,091	194,950
Total	920,502	512,192	.....

Copper-base Alloy

(Shipments of castings—1000 pounds[1])

	Shipments			Unfilled
	Total	Sand	Perm. Mold	Orders[2]
1948	1,030,825	930,790	59,009	.....
1949				
Dec.	63,873	58,291	3,086	23,435
Total	724,053	654,444	37,311	.....
1950				
Jan.	65,585	58,878	3,440	25,216
Feb.	67,029	60,257	3,626	26,923
Mar.	80,442	71,876	4,693	27,631
Apr.	72,318	64,773	3,848	28,769
May	79,108	71,605	3,751	30,880
June	83,023	74,990	3,896	32,808
July	69,033	62,414	3,789	39,906
Aug.	94,013	85,948	4,258	52,513
Sept.	95,641	87,111	4,630	58,673
Oct.	105,746	96,911	5,064	66,560
Nov.	103,694	93,607	5,776	67,931
Dec.	100,548	90,513	5,985	69,569
Total	1,016,180	918,883	52,756	.....

Aluminum

(Shipments of castings—1000 pounds[1])

	Shipments				Unfilled
	Total	Sand	Perm. Mold	Die	Orders[2]
1948	424,490	139,781	161,334	118,738	.....
1949					
Dec.	26,762	10,070	7,714	8,430	36,921
Total	304,409	106,825	102,908	87,812	.....
1950					
Jan.	28,801	9,646	9,400	9,052	40,591
Feb.	28,887	10,171	9,358	8,851	44,235
Mar.	35,845	13,035	11,094	10,870	47,350
Apr.	33,356	11,091	10,656	10,795	49,952
May	36,031	11,526	11,928	11,799	52,580
June	37,600	12,677	11,825	12,173	53,309
July	30,152	9,613	9,808	9,943	63,892
Aug.	39,852	14,117	12,682	12,207	82,564
Sept.	42,061	14,369	13,085	13,594	89,723
Oct.	47,278	15,994	14,893	15,408	102,938
Nov.	46,816	16,099	14,040	15,715	67,931
Dec.	45,999	15,675	15,052	14,322	104,380
Total	452,610	154,013	143,821	144,661	.....

Magnesium

(Shipments of castings—1000 pounds[1])

	Shipments		Unfilled
	Total	For Sale	Orders[2]
1948	8,214	7,488	....
1949			
Dec.	781	738	2,216
Total	9,364	8,781	....
1950			
Jan.	814	762	2,237
Feb.	735	676	2,218
Mar.	903	849	2,322
Apr.	799	751	2,305
May	810	762	2,282
June	758	698	2,482
July	727	677	3,356
Aug.	1,147	1,078	4,855
Sept.	1,231	1,154	4,942
Oct.	1,354	1,297	5,573
Nov.	1,508	1,434	6,928
Dec.	1,528	1,444	6,958
Total	12,314	11,582	....

Foundry Production Workers

Estimated Number

	Nov. 1950	Oct. 1950	Nov. 1949
Iron & Steel	232,500	226,800	169,400
Nonferrous	91,900	89,800	62,400

Average Weekly Earnings

Gray Iron	$69.22	$70.58	$54.35
Malleable Iron	69.28	69.15	51.14
Steel	69.75	69.63	55.14
Nonferrous	74.97	72.29	61.90

Average Weekly Hours

Gray Iron	43.4	44.5	37.3
Malleable Iron	42.4	42.5	33.6
Steel	42.4	42.9	35.9
Nonferrous	42.5	48.8	39.1

Labor Turnover Rate (Nov.)

(Per 100 employees)

	Total Accession	Total Separation	Quit	Layoff
Gray Iron	7.1	4.9	3.4	0.4
Malleable Iron	6.1	3.9	3.1	0.05
Steel	6.3	4.1	2.9	0.4
Nonferrous	5.1	4.7	2.8	0.8

Source: Bureau of Labor Statistics.

Gray Iron Castings—Shipments

(Net tons[1])

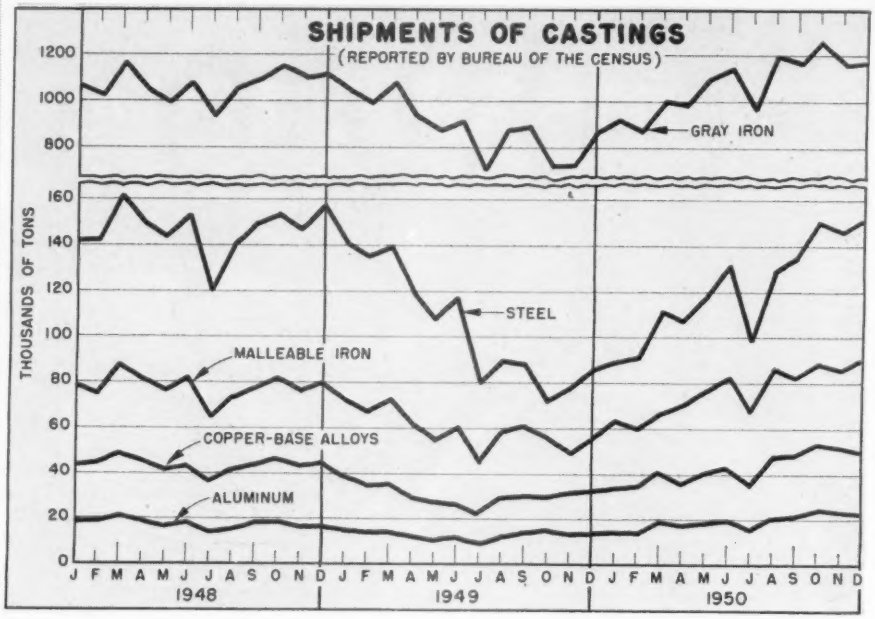
	All Castings		Miscellaneous Castings		Heavy Steel Ingot Molds		Chilled Railroad Car Wheels		Pressure Pipe & Fittings	Soil Pipe & Fittings	Unfilled Orders[2]
	Total	For Sale	Total	For Sale	Total	For Sale	Total	For Sale	Total[2]	Total[2]	Total
1948	12,785,909	7,131,405	8,296,843	3,839,671	1,979,740	865,022	719,784	641,164	1,149,553	639,989	.....
1949											
Dec.	862,172	440,409	521,613	200,760	183,660	87,241	34,772	30,281	65,764	56,363	892,458
Total	10,549,284	5,521,441	6,624,420	2,675,411	1,776,242	759,860	555,569	493,117	1,029,743	563,310	.....
1950											
Jan.	913,321	449,577	573,743	214,752	188,152	88,244	34,254	29,409	64,095	53,077	914,185
Feb.	864,189	416,594	551,060	201,468	169,605	75,832	33,417	29,187	63,363	46,744	873,455
Mar.	995,782	500,195	635,403	244,122	170,082	71,317	44,898	39,357	89,264	56,135	921,575
Apr.	981,126	483,862	621,368	233,397	182,420	77,923	42,768	37,972	82,774	51,796	922,255
May	1,095,111	572,887	684,632	277,447	195,021	86,016	46,219	40,185	104,529	64,710	977,833
June	1,136,129	613,084	713,811	300,863	197,474	91,377	45,672	41,672	106,980	72,192	1,039,618
July	961,450	507,867	595,918	241,632	177,154	82,363	35,066	30,560	94,438	58,874	1,286,579
Aug.	1,201,569	677,134	747,046	335,868	199,770	92,340	52,508	46,681	131,127	71,118	1,670,380
Sept.	1,159,240	648,966	722,667	325,019	203,191	94,968	44,707	40,304	121,556	67,119	1,794,118
Oct.	1,254,901	700,512	792,764	364,607	220,821	100,082	46,516	41,023	119,105	75,695	1,839,866
Nov.	1,160,770	656,745	733,570	343,073	194,271	85,057	44,382	40,068	115,465	73,082	1,930,176
Dec.	1,181,974	652,929	745,766	333,033	210,700	98,071	43,667	39,984	111,066	70,775	618,278
Total	12,905,562	6,880,352	8,117,748	3,415,281	2,308,661	1,043,590	514,074	456,402	1,203,762	761,317	.....

Steel Castings—Shipments

(Net tons[1])

	All Castings			Carbon Steel			Alloy Steel			Unfilled Orders[2]
	Total	For Sale	Railway Specialties[3]	Total	For Sale	Railway Specialties[3]	Total	For Sale	Railway Specialties[3]	Total
1948	1,760,032	1,335,295	442,258	1,366,913	1,063,027	425,965	393,981	272,374	16,293	.....
1949										
Dec.	85,033	53,079	9,258	60,864	37,205	8,831	23,644	15,874	427	122,887
Total	1,250,460	865,297	232,976	944,232	659,454	223,310	299,270	205,843	9,666	.....
1950										
Jan.	88,821	57,996	9,298	64,616	41,559	8,607	24,205	16,437	691	142,484
Feb.	91,827	62,045	10,920	66,843	44,473	9,589	24,984	17,572	1,331	165,186
Mar.	111,772	77,588	15,281	82,458	56,492	14,012	29,314	21,096	1,269	185,611
Apr.	106,964	75,133	17,406	79,912	56,008	16,124	27,052	19,125	1,282	201,643
May	117,944	83,845	20,552	88,202	63,658	18,811	29,742	20,187	1,741	198,078
June	131,097	94,637	27,065	96,365	72,427	24,653	34,732	22,210	2,412	206,799
July	98,269	68,874	15,734	70,122	51,204	14,577	28,147	17,670	1,157	255,418
Aug.	128,369	94,413	24,922	92,197	70,721	22,952	36,172	23,692	1,970	329,944
Sept.	134,574	96,738	25,295	98,523	74,052	23,992	36,051	22,686	1,303	427,969
Oct.	149,558	109,660	30,048	112,704	85,157	28,493	36,854	24,503	1,555	521,846
Nov.	145,929	108,263	30,775	110,476	84,316	29,245	35,453	23,947	1,530	537,666
Dec.	155,258	113,692	34,061	118,744	88,552	32,160	36,514	25,140	1,901	554,187
Total	1,459,382	1,042,884	261,357	1,081,162	788,619	243,215	379,220	254,265	18,142	.....

[1] Source: Bureau of the Census. [2] All cast iron pipe is shipped for sale. [3] For sale only.



Index of Foundry Equipment Orders

Foundry Trades Only

(Net Orders Closed, New Equipment)

	1950	1951
Jan.	159.3	668.0
Feb.	113.1	....
Mar.	225.2	....
Apr.	160.6	....
May	294.9	....
June	622.7	....
July	401.8	....
Aug.	693.6	....
Sept.	483.8	....
Oct.	526.8	....
Nov.	885.5	....
Dec.	526.2	....

Note: Figures are percentages of the base period 1937-1939 taken as 100 per cent (monthly average). Source: Foundry Equipment Manufacturers Association.

Coke Production and Consumption

(Net tons*)

	Production	Consumption Total	Consumption By Foundries
1948	74,861,928	74,214,497	3,750,300
1949			
Dec.	5,637,800	5,903,287	228,203
Total	63,637,429	63,462,233	2,778,868
1950			
Jan.	5,482,034	5,893,697	253,057
Feb.	3,994,106	4,628,331	201,927
Mar.	5,280,660	5,371,012	241,844
Apr.	6,156,294	6,005,632	277,673
May	6,397,032	6,385,493	294,334
June	6,238,067	6,255,094	276,555
July	6,368,489	6,265,821	267,142
Aug.	6,417,404	6,420,483	278,306
Sept.	6,263,214	6,243,584	274,657
Oct.	6,649,935	6,543,428	332,444
Nov.	6,243,970	6,131,733	317,120
Dec.	6,606,464	6,590,823	322,458
Total	72,097,669	72,735,131	3,337,517

Ingot Brass and Bronze

(Shipments in net tons)

	1950	1951
Jan.	18,874	28,416
Feb.	18,487	.....
Mar.	22,494	.....
Apr.	22,118	.....
May	23,643	.....
June	25,093	.....
July	21,609	.....
Aug.	29,689	.....
Sept.	28,811	.....
Total for year	303,563	.....

Zinc-Base Alloy

(Shipments of castings—1000 pounds[1])

	Shipments Total	Shipments For Sale	Unfilled Orders[2]
1949	377,779	248,679	.....
1950			
June	48,818	29,832	56,899
July	42,188	25,252	62,467
Aug.	47,212	29,897	80,318
Sept.	49,079	31,125	89,787
Oct.	51,031	33,287	97,102
Nov.	48,852	32,844	102,524
Dec.	47,818	31,161	102,636
Total	536,398	341,833	.....

Iron and Steel Scrap Consumption

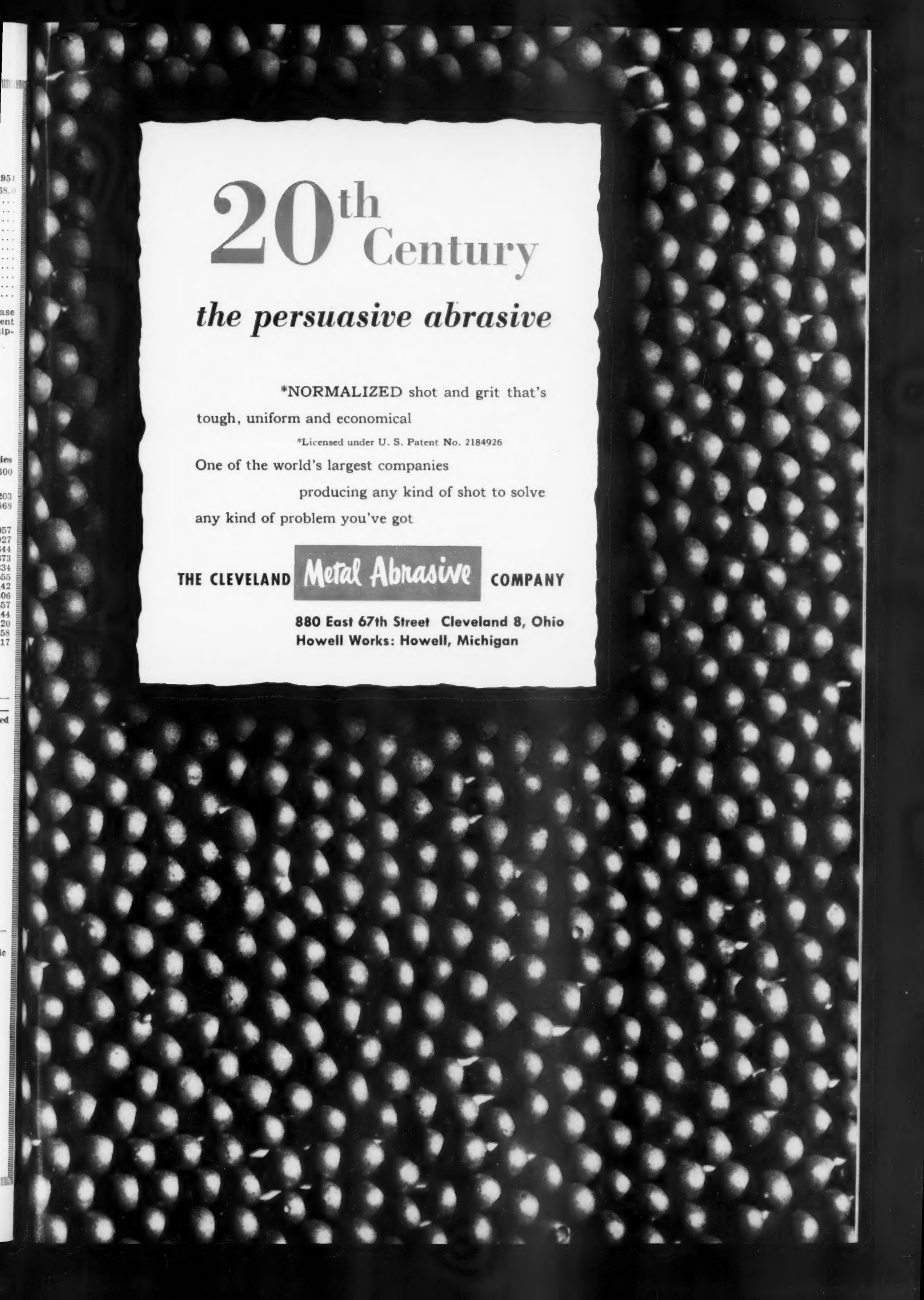
(Thousands of gross tons*)

	All Scrap Total	All Scrap Purchased	By Type of Furnace: Cupola Total	Cupola Purchased	Air Total	Air Purchased	Electric Total	Electric Purchased
1949								
Nov.	3,037	1,434	612	310	53	17	291	180
11 mo.	44,531	20,693	7,302	4,843	734	253	3,860	2,375
Dec.	4,750	2,229	666	332	67	23	379	233
Total	49,281	22,922	7,968	4,175	801	276	4,239	2,608
1950								
Jan.	4,906	2,267	699	337	71	25	433	259
Feb.	4,539	2,149	670	315	71	27	417	253
Mar.	5,101	2,430	778	372	87	31	497	296
Apr.	5,119	2,451	766	365	79	29	493	300
May	5,333	2,552	837	416	85	32	539	324
June	5,122	2,483	864	427	92	33	533	317
July	4,708	2,244	669	318	79	28	490	295
Aug.	5,202	2,454	862	426	108	39	568	327
Sept.	5,170	2,468	819	404	109	40	579	348
Oct.	5,643	2,707	866	437	108	40	643	384
Nov.	5,293	2,598	841	431	107	39	593	364
11 Mo.	56,136	26,803	8,671	4,248	996	363	5,785	3,467

Pig Iron Production and Consumption

	Production** (Standard grades—1000 net tons) Total	Foundry	Malleable	Basic	Low Phos. Intermediate Low Phos. & Bessemer	Consumption* (By type of furnace, 1000 gross tons) Total	Cupola	Air	Electric
1949									
Nov.	2,687.5	192.5	131.3	2,024.0	339.7	2,476	331	15	5
11 mo.	48,242.7	3,572.2	2,070.5	37,352.9	6,247.1	43,272	4,125	215	83
Dec.	5,166.0	249.7	218.6	3,959.6	738.1	4,656	385	20	13
Total	53,408.7	2,821.9	2,294.5	41,312.5	6,979.8	47,928	4,510	235	96
1950									
Jan.	5,209.0	239.3	226.4	4,033.2	710.1	4,719	421	20	10
Feb.	4,120.1	151.1	187.9	3,239.3	541.8	3,890	396	20	80
Mar.	4,546.8	232.4	201.2	3,554.9	558.3	4,267	448	23	8
Apr.	5,502.8	259.2	229.1	4,298.3	716.2	4,954	449	23	11
May	5,773.6	257.7	223.5	4,572.3	720.1	5,203	474	24	13
June	5,549.3	209.5	257.7	4,393.8	688.3	5,033	494	25	13
July	5,804.2	269.3	282.2	4,561.2	691.5	5,018	403	23	14
Aug.	5,706.2	257.0	284.0	4,407.3	757.9	5,136	516	30	18
Sept.	5,614.6	244.0	257.2	4,380.9	732.5	5,092	500	26	17
Oct.	5,836.8	284.1	260.6	4,541.2	741.0	5,219	466	31	13
Nov.	5,609.2	264.9	260.2	4,374.4	709.8	4,817	462	30	14
11 Mo.	59,272.6	2,593.4	2,745.1	46,356.8	7,567.5	53,348	5,029	275	311

* Source: U. S. Dept. of Interior, Bureau of Mines. ** Source: American Iron & Steel Institute. [1] Source: Bureau of the Census.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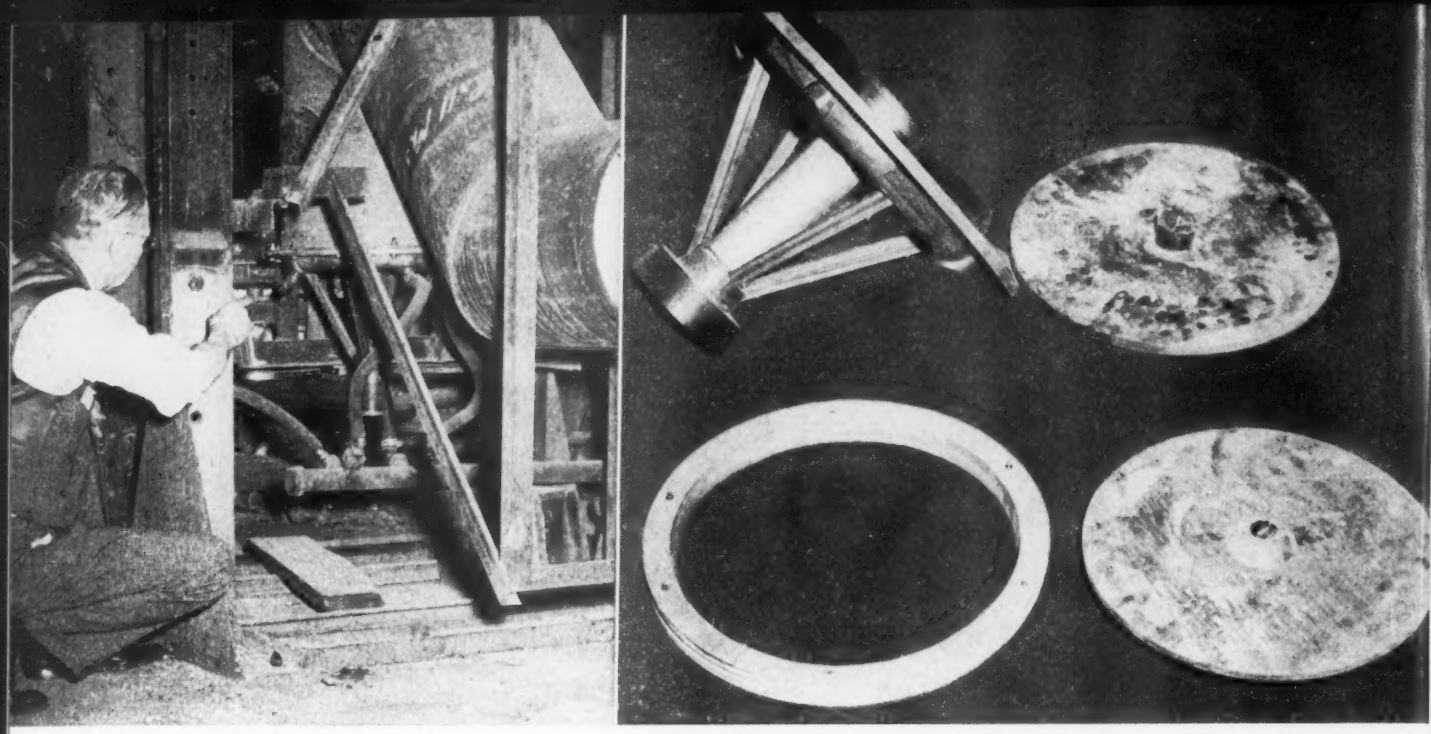


Left—A. L. Goodreau, G-B Brass & Aluminum Foundry Inc., Los Angeles, points out details of ultrasonic siren used to agglomerate furnace smoke. *Right*—Wood patterns used to cast principal components of the ultrasonic siren

REPORT ON *Ultrasonics*

By THOMAS A. DICKINSON

ALTHOUGH its importance may appear to be slight in terms of current applications in actual foundry operations, the science of ultrasonics has opened up what could become a fertile field for new developments in foundry materials and equipment as well as a new market for castings.

Ultrasonic science is based on the study of acoustical phenomena in a number of categories which can be generally designated as waves or vibrations of extreme intensity or of very high or low frequencies. This includes audible sound waves as well as inaudible "subsonic" or "supersonic" vibrations in varied circumstances.

These waves or vibrations can be generated with a number of different types of equipment, and may be propagated in liquids, solids, or gases at various frequencies and intensities so as to accelerate chemical reactions, cause disintegraton, facilitate the detection of defects in metals, produce special heating or cleaning effects, etc.

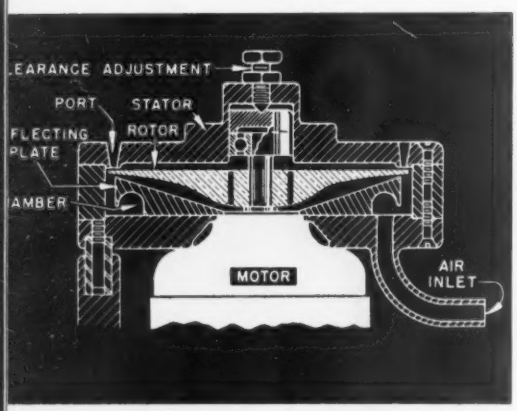
G-B Brass & Aluminum Foundry, Inc., Los Angeles, is one of the few companies which have pioneered in ultrasonic development work. According to A. L. Goodreau, president, the company's original intention was to develop a supersonic generator for the agglomeration of smoke particles emerging from the plant's furnaces in order to conform with the requirements of local smog-control ordinances. "The prototype siren has been designed, constructed, and successfully production-tested—so successfully, in fact, that we're now getting ready for a number of follow-up projects," he stated. "We are especially interested in the potentialities of ultrasonic equipment for the inspection of sand castings, and we feel that high-frequency vibrations might even be used to facilitate the fabrication of dry sand molds."

A number of foreign manufacturers are known to have developed supersonic sirens for industrial usage, but Ultrasonic Corp., Cambridge, Mass., is believed to be the only American company aside from the G-B foundry organization which has thus far accomplished such fabrication work.

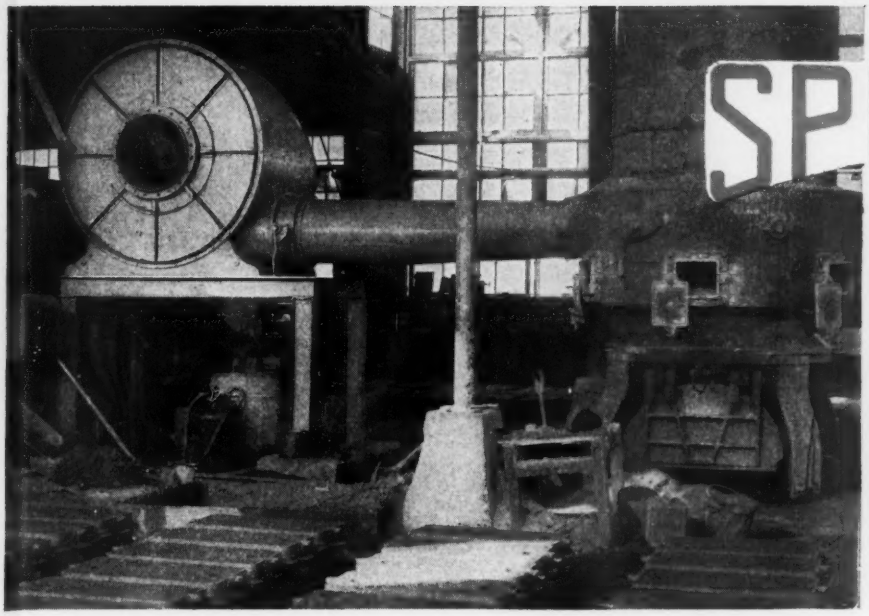
Operationally, the ultrasonic sirens that have been made by the two American companies are very similar—since each involves the generation of vibrations by ejecting a stream of compressed air through a pair of perforated discs, one of which is stationary while the other is rotated at different speeds to produce waves of various frequencies. However, the Cambridge firm's siren was primarily designed to produce sonic vibrations of high intensities (usually in the audible sound range) while the Los Angeles company's generator is capable of producing inaudible high-frequency waves.

According to Dr. E. A. Alexander,

(*Continued on page* 226)



Schematic side view of an ultrasonic siren assembly



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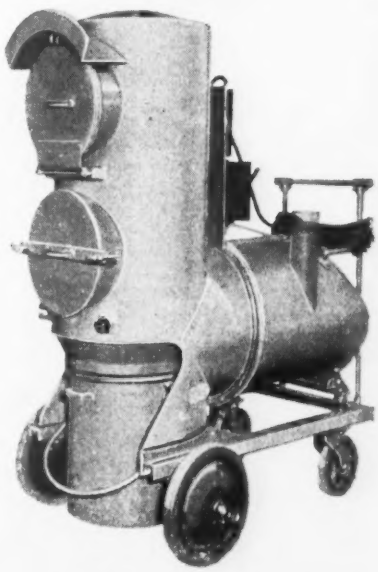

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Crucible Melters' Handbook is now in its Fourth Edition; published in Spanish and in Portuguese as well as English. Mailed free, no obligation, to anyone interested in non-ferrous melting. Write today.

(*Continued from page* 224)

who designed the latter unit, high-frequency vibrations are as effective as high-intensity vibrations in agglomerating smoke particles; and, in addition, the former can be generated with less power.

Except for a steel drive shaft, all parts of the G-B siren were made by high-tensile manganese bronze castings. As illustrated, page 224, such parts include a housing unit, a mounting ring, a stator and a rotor.

Stator and rotor components are 16-in. disks with 120 perforations in each unit. Each perforation is $\frac{3}{16}$-in. diam. The rotor is mounted on the aforementioned drive shaft, which is belt-driven at various rotational speeds by a 3½-hp motor.

Assembled, the G-B siren has a maximum length of 18 in., an optimum diameter of 17-in. and weighs 240 lb. It is vertically mounted so that its output will be upward into a vertical smokestack, on which collector pipes are mounted to accumulate agglomerated smoke particles.

High First Cost

Air pressures of 5 to 10 psi and rotational speeds up to 12,000 rpm have been used to generate frequencies of 20 to 22 kilocycles with the G-B siren; and, while the cost of the prototype setup was rather high, Mr. Goodreau believes that production replicas of the initial generators can be made for as little as $1000 each.

Ultrasonic reflectoscopes have been used by companies such as Todd Shipyards at San Pedro, Calif., to detect flaws in steel and other types of castings which ranged to more than 30 in. in thickness. Such reflectoscopes are manufactured by Sperry Products Inc., and their operation can in essence be attributed to the tendencies of quartz and other piezoelectric crystals to vibrate at high frequencies when they are energized by the terminals of a radio-frequency amplifier.

Reflectoscope vibrations are generated at frequencies which correspond with the resonance properties of various materials, so that the ultrasonic waves can be reflected through solids of all types and dimensions much the same as light is reflected by a mirror. Reflections of ultrasonic waves are conveyed to an amplifier unit resembling a radio receiving set, the visual indications being registered on the calibrated face of a cathode tube.

Purpose of the latter tube and related electronic equipment is to indicate the presence or absence of defects in conformity with the resistance encountered in various materials

(*Continued on page* 228)

NOT JET-PROPELLED

but...the next thing to it!

...the fastest forward speed
...unmatched maneuverability

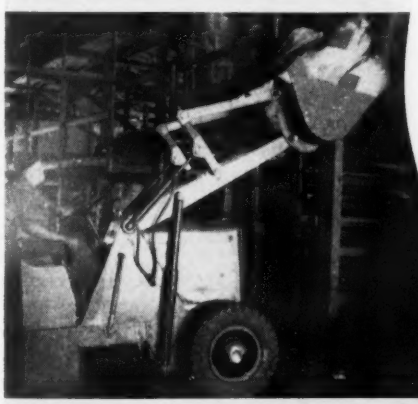
THE NEW **'butler 102'**

The new ***'butler 102'*** is designed, engineered and built to outperform any similar machine in the materials handling field! Always the world's quickest scoop-type boxcar unloader because of superior maneuverability and shorter turning radius, *now* its greatly increased forward speed — 11 miles per hour — gives the ***'butler'*** a notable advantage over the next best contender. And 11 miles per hour means a lot more trips per day.

The new ***'butler 102'*** is built for rugged work in factory yards as well as in boxcars, on platforms and floors. Big pneumatic-tired wheels and balanced steering handle rough terrain — and there's plenty of power to charge up slopes.

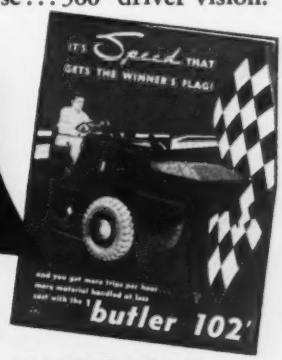
The new ***'butler 102'*** dumping foundry sand into a sand-cutter. The new instant acting "Hydro-Dump" Scoop discharge saves many seconds that build up to hours per week.

Check these features — You'll find the ***'butler'*** wins on every point... 11 miles per hour forward speed... 6'3" turning radius... hydraulically controlled bucket of 1000 lbs. capacity... discharge height 60"... split-second forward to reverse... 360° driver vision.



The new ***'butler 102'*** has plenty of reach for loft storage. Crates, castings, baled, barrelled or boxed materials are readily transported. And of course anything granular in nature.

Get *all* the information about the new ***'butler 102'!*** The instant acting "Hydro-Dump"... the new simplicity of controls... all the features that make the new ***'butler'*** outstanding in handling just about every material. Send for Bulletin 250B.



BUTLER BIN CO.

CARSCOOP DIVISION

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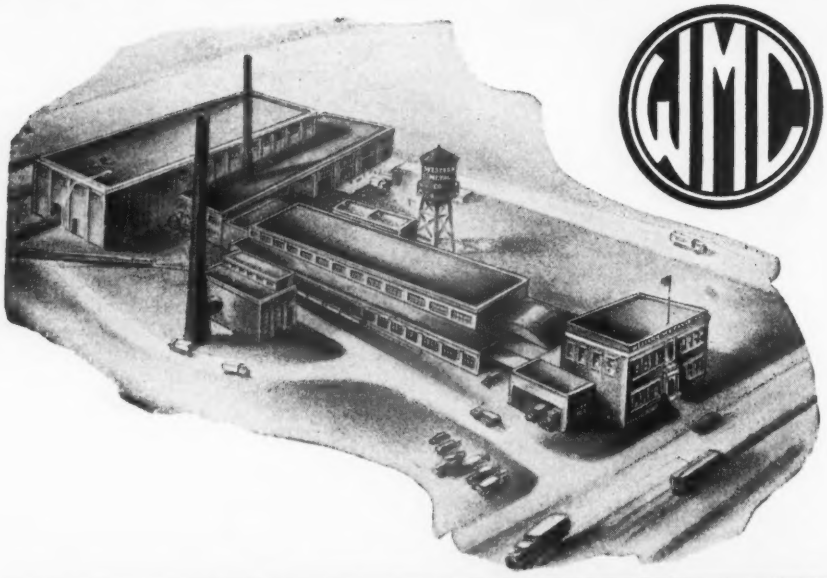

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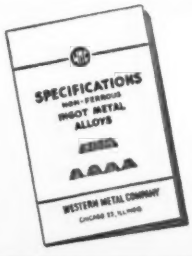
INGOT METALS

BRASS • BRONZE
• ALUMINUM •

We produce Brass, Bronze and Aluminum Ingots to your exact specification and can provide complete laboratory service as well as field metallurgists to help you produce the quality castings necessary to insure the standards of today's requirements. We have built our reputation on quality and service . . . it will pay you to investigate Western.



WRITE FOR NEW BULLETIN "F"

Here in one booklet is a complete summary of tables including A.S.I.M., U. S. Federal, U. S. Navy and S.A.E. specifications as well as nonferrous ingot metal alloys for all various modern industrial classifications. This bulletin will be of utmost value to you as will an acquaintance with a truly reliable ingot manufacturer, for the successful operation of your foundry.

WESTERN METAL COMPANY

3201 SOUTH KEDZIE AVE. CHICAGO 23, ILLINOIS

SMELTERS AND REFINERS OF BRASS AND ALUMINUM INGOTS

(*Continued from page* 226)

by measuring the time required to produce each reflection or pulse. The visual indications may be photographed where it is necessary to maintain permanent records of inspection operations.

Magnetostriction generators should efficiently produce ultrasonic energy for a number of foundry applications; and, according to Frank Massa of Massa Laboratories Inc., Cleveland, such equipment has already been used for unusual tasks which include the alloying of copper and steel.

In a magnetostriction generator, supersonic vibrations are produced by rapidly and intermittently polarizing electromagnets so that their influence will vary the length of a ferrous bar or tube (due to the phenomenon of magnetostriction). Vibrations thus produced in the bar or tube may be of considerable magnitude or intensity, but are more or less limited to the lower range of supersonic frequencies (i.e., from about 20 to 100 kilocycles).

Degas Molten Metal

Magnetostriction generators are said to be especially useful in alloying or compounding various substances—including many metals and other materials which have heretofore been regarded as incompatible—because of intense agitational effects, which in the case of iron and copper alloys prevent separation as the molten materials solidify on cooling.

Further, according to reports of some investigators, it should be possible to utilize the output of magnetostriction generators to degas molten metal.

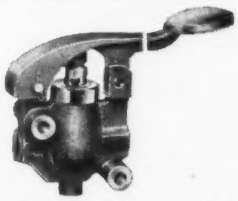
At General Sound Co., Burbank, Calif., as well as at the aforementioned Massa Laboratories, magnetostriction generators and related equipment have been used for cleaning purposes—e.g., in degreasing various types of castings. This normally involves the dispersion of supersonic waves with frequencies in the neighborhood of 33 kilocycles in standard chemical cleaning solutions, and is advantageous in that it increases the wetting action of the solutions—thus reducing time requirements from a matter of hours to minutes or seconds.

Theoretically, Galton-type whistles can be powered with steam or compressed air to produce ultrasonic vibrations of virtually all practical frequencies and intensities. Whistles, by virtue of their structural simplicity and possible operational efficiency, may eventually become the most inexpensive and practical ultrasonic generators for all-purpose usage.

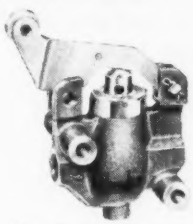
(*Concluded on page* 230)

Schrader Valves — Practical answers to air control problems

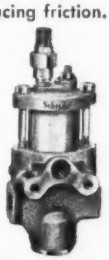
To meet the vast and increasing variety of applications for air cylinders and other air line accessories, Schrader supplies a comprehensive range of equally useful control and operating valves for operation by hand, foot or cam. Shown below are just a few from Schrader's more than a hundred models.



Hand Lever—This is the standard hand operated valve. Brass body with stainless steel parts. Can be mounted rigidly at any angle. Specially constructed lever makes operation easy and safe.



Valves with roller lever—These valves are designed for any cam actuation. The free turning roller riding on a cam provides long life by reducing friction.

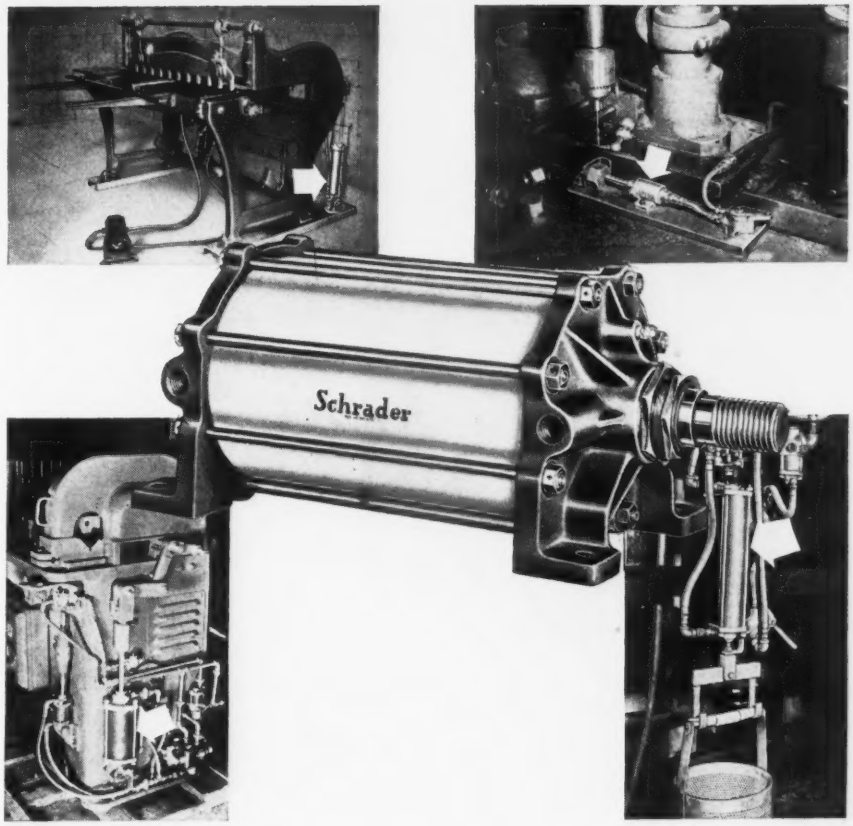


Pilot valves—Both two and three way, with or without timer. Normally open or normally closed. Provides instant power at remote points.

Foot Lever—This valve supplies line pressure to single acting cylinders. It is functionally designed for "tip-toe" operation.

Air Cylinders • Operating Valves • Press & Shear Controls • Air Ejection Sets • Blow Guns • Air Line Couplers • Air Hose & Fittings • Hose Reels • Pressure Regulators & Oilers • Air Strainers • Hydraulic Gauges • Uniflare Tube Fittings

Schrader
PRODUCTS
CONTROL THE AIR



Four ways that air power can increase production in your plant

You can make hard work easy, eliminate manual effort and speed up production by substituting air power . . . often the best, usually the economical way to apply force where you need it. For example:

- ***To provide a powerful push***
- ***Where clamping is necessary***
- ***For lifting operations***
- ***To power a reciprocating motion***

Shown above are just a few of the many thousands of applications of Schrader Air Cylinders in plants throughout the country. Undoubtedly they will suggest many places in your own plant where Schrader Air Cylinders will be just the thing.

Ask us to help you determine what will best fit your needs. Send us a letter outlining your particular installation requirement, your idea, or fill out the coupon below.

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What Does

Mean To You?

A test run of "T" Abrasives in *your* plant under *your* supervision will conclusively prove to you that—

- "T" means faster cleaning of castings, forgings and heat treated parts!
- "T" means up to 88% longer abrasive life!
- "T" means longer equipment life — blades, slats, end plates, etc.
- "T" means 15% to 50% reduction in total maintenance and abrasive costs.

The specific claims made above are backed by *A SPECIFIC PERFORMANCE GUARANTEE* by the producers, National Metal Abrasive Co. and Western Metal Abrasives Co.

For full particulars about "T" Shot and Grit and PERMA-BRASIVE, The "MALLEABLIZED "T" Abrasive, contact the H. W. office nearest you.

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Established 1890

(*Concluded from page* 228)

In laboratory test work, tuning forks and spark-gap equipment have been used to generate low and moderately-high ultrasonic frequencies; but, to date, no efforts have apparently been made to develop generators of these types for commercial usage.

The highest ultrasonic frequencies thus far generated are known to have exceeded 500,000 kilocycles, and were produced with crystal-type generators of the types being made for experimental work by Fisher Scientific Co., Pittsburgh. However, despite the fact that the higher frequencies can be produced, it is believed that equipment design problems may preclude the use of supersonics in many fields of industrial work for several years.

For example, in the design of ultrasonic generators which can be operated for any appreciable interval of time at frequencies exceeding 300 kilocycles, it will be necessary to find ways and means of preventing heat damage to the equipment—since the localized heat concentration of an ultrasonic generator may exceed that of an electric light bulb.

In high-frequency crystal generators, the problem of overheating (which causes piezoelectric crystals to crack) has been solved for intermittent test or inspection purposes by immersing quartz elements in cooling oil baths; and it is possible that longer operational intervals can be maintained in this connection by new-type ceramic crystals, which have been "synthesized" by Brush Development Co., Cleveland.

An ultrasonic welding process was reportedly developed by British manufacturers in 1949, but no comparable process is yet known to be in use in the United States.

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ASTM Issues Supplement

Supplement to the American Society for Testing Materials publication *Metal Cleaning Bibliographical Abstracts* (1893-1949) published in 1949 contains 170 additional reference through 1950. As in the original bibliography, the references are arranged by year and then by author, subject, specification, and patent. The original bibliography is $2.75, the supplement $1. When ordered together, both cost $3. Requests should be addressed to ASTM, 1916 Race St., Philadelphia 3.

Brief Notes for Busy Foundrymen

THE BEGINNING AND THE END . . .

THE MULLER

Not enough can be said about mulling and aerating. In most foundries the muller will pay for itself by obtaining as near maximum green strength as possible. Aerating is important to the moulder, as it makes the sand more fluffy and easier rammed about the pattern. Many types of mullers, pug mills or paddle mixers are available, and each has advantages and disadvantages which can be clearly pointed out by companies handling such equipment. A unique method of rebonding the foundry sands by first placing the bond in a water slurry and then adding to the mixer, pug mill or paddle mixer or muller that are directly on the sand floors, is rapidly gaining prominence and also saving money in the purchase of bonding agents. Write for Data 241, "Sperser Method of Rebonding Molding Sand."

THE SHAKE-OUT

It is wise to allow an apprentice or a new man in the foundry to observe the shake-out and point out its importance, as one standing at the shake-out can readily see if the sand is collapsing as it should and if the sand is burning-on to the castings. All gating arrangements can be clearly seen, many casting defects such as cold shuts and misruns can be observed, and pouring can be observed just as well at the shake-out as well as the pouring floors in determining excess metal loss or pouring short. Many other production operations can be noticed at the shake-out whereas they may be overlooked at the actual operations. A good sand man always visits the shake-out at least once each hour to observe the manner in which the castings are peeling and whether or not the sand is passing through the shake-out as it should.

Our Best Ads are Shipped to Foundries . . . in Trade-Marked Bags

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VOLCLAY Western Bentonite • FIVE STAR Wood Flour • PANTHER CREEK Southern Bentonite

AMERICAN COLLOID COMPANY Chicago Illinois • Producers Since 1927

Available from Leading Foundry Suppliers in the United States and Canada

Foundry work moves faster with

2 SPEED METEOR ELECTRIC HOISTS

Capacities from ½ to 5 tons

To meet demands for greater production and higher efficiency, many progressive foundries are replacing obsolete, undependable handling equipment with new heavy duty, two-speed Meteors. Designed specifically for foundry work, the Meteor provides slow speed for careful starting of loads... and high speed for fast lifting when the load is free. The Meteor is fully enclosed, weather-proofed and protected against dust and dirt. Airplane-type cooling fins quickly dissipate heat generated by gears and load brake. Low headroom, precision construction, motor thermal protection, only 110 volts in push button station, helical gears, are other quality features. If you want extra value for your investment, write today for literature and prices.

WRITE *for Bulletin 142... contains 22 pages of specifications, illustrations and prices.*

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(Affiliated with Columbus-McKinnon Chain Corporation)

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Birmingham Conference

(*Continued from page* 180)

time tests utilizing the cutting force or the rate of penetration. Annealing probably offers the best way to improve machinability, but this adds to the cost and many small foundries do not have the capital to invest in annealing furnaces. Therefore other methods which revolve around ladle additions are considered.

That machinability can be improved much better with low-sulphur irons was stated by Dr. Austin. He discussed various methods of desulphurizing, including the use of fused soda ash, injecting calcium carbide in the ladle and melting in the basic-lined cupola. Cost and efficiency of the various methods were discussed. He described experiments in the use of bismuth additions. While small additions promote graphitization and produce a ferritic structure, the metal also has a tendency to chill the casting surface. Results of the studies show that zirconium-treated high-phosphorus irons have approximately the same tool life as low-phosphorus irons.

Substitutes for Manganese

The last paper on the program was presented by Warren C. Jeffery, University of Alabama, Tuscaloosa, Ala., on "Zirconium for Manganese in Cast Iron." Ross W. Martin, production superintendent, McWane Cast Iron Pipe Co., Birmingham, presided. Mr. Jeffery pointed out that manganese, which is added to offset the harmful effects of sulphur, is becoming scarce and that other materials which might accomplish the same purpose are important, especially during this emergency. Tests have shown that zirconium ferrosilicon can be substituted, and that the cost is low.

Based on the results of an investigation, Mr. Jeffery offered the following conclusions:

1. Whether added as a ladle addition or as a part of the cupola charge, zirconium is a more potent sulphide former than manganese.

2. Because of its sulphide forming ability, zirconium will replace ordinary or commonly made manganese additions to cast iron.

3. Zirconium additions to gray cast iron soften the iron by reducing the stability of the carbides and by promoting the formation of a ferritic matrix.

4. ZrFeSi additions to cast iron decrease the chilling tendency, and increasing ZrFeSi additions up to 0.13 per cent contained Zr causes corresponding decrease in the chilling ten-

(*Concluded on page* 234)

SLY TUMBLING MILLS

THE STANDARD OF STURDINESS

The SLY name on your Tumbling Mills has been the Standard of Sturdiness for many years.

Modern Design Throughout

Anti-Friction Bearings — Direct Motor Drive

Sturdy Construction for

Long Life — Low Maintenance

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Inside diameters: 24″, 30″, 36″, 42″, and 48″.
Inside length from 36″ up.

Special Designs for

Stove Plate	Sprue Cleaning
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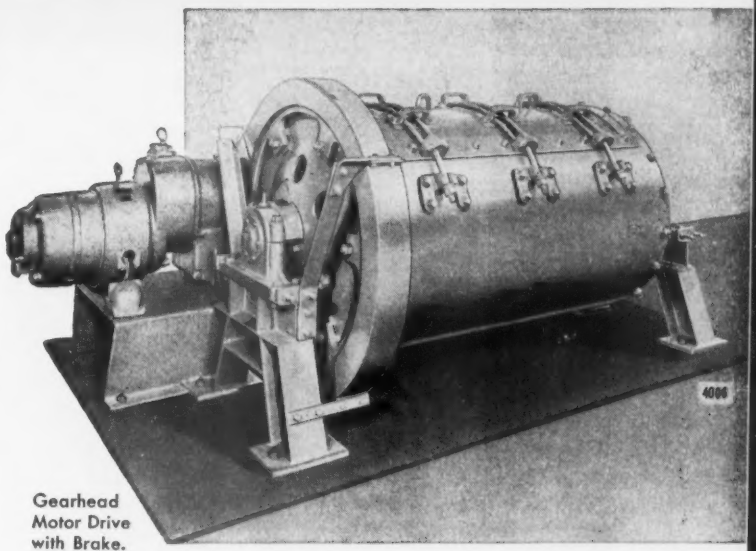
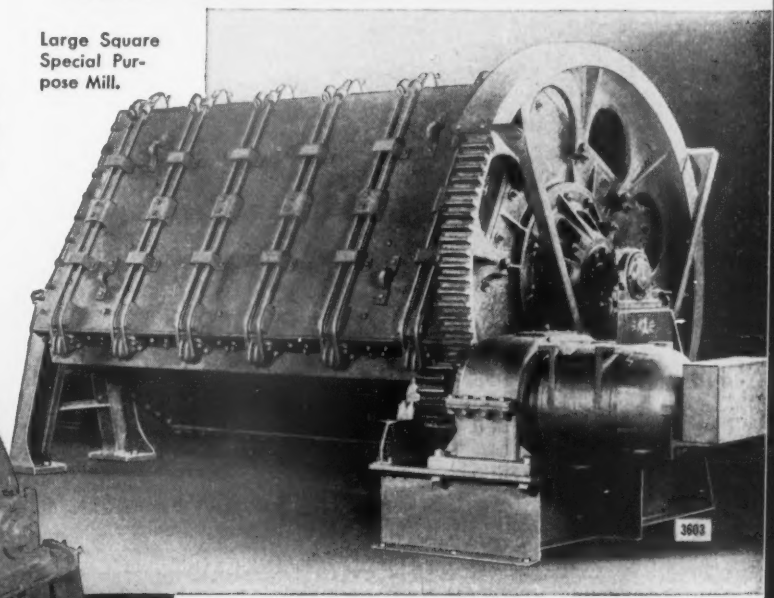
Drives for Mills

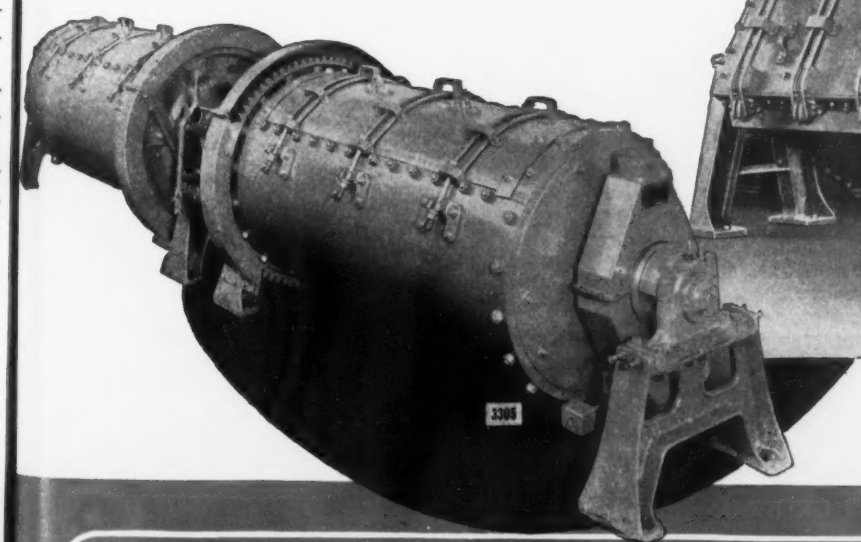
For greatest flexibility we recommend individual direct motor drive, but mills can also be furnished with V-belt drive, or tight and loose pulley for flat belt drive.



Gearhead Motor Drive with Brake.



Large Square Special Purpose Mill.



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EXTRA TOUGH

"Certified" Abrasives

Switch to Certified Abrasives and keep cleaning costs down! Certified's Samson Shot and Angular Grit are made *extra tough* by a special *automatically controlled* hardening process. They wear longer, can be used over and over again . . . and assure fast, efficient, high-quality blast cleaning. Try Certified in your cleaning room and you'll see why it's *first choice* in hundreds of foundries!

All sizes graded to S. A. E. specifications

Experienced foundrymen say:

Always specify "Certified"

Accepted and used for over 55 years

PITTSBURGH CRUSHED STEEL CO.
Pittsburgh, Pa.
STEEL SHOT AND GRIT CO.
Boston, Mass.

MEMBER FEMA

(*Concluded from page* 232)

dency of an iron.

5. Zirconium additions to cast iron refine the graphite structure when present in excess of the amount necessary to combine with sulphur.

6. Zirconium additions between 0.1 per cent and 0.40 per cent increase the machinability of gray cast irons. There is, however, an optimum amount of zirconium addition which produces the greatest increase in machinability. This optimum amount seems to occur at approximately 0.20 per cent added zirconium. This optimum amount may be lower for lower sulphur irons.

Discussion brought out the fact that most of the work was done at 2750 to 2800° F, and that the material does not seem to work so well when added to metal of a lower temperature.

Foundries Open To Visitors

Friday morning was devoted to plant visitation. Ray F. Frings, sales engineer, Harry G. Mouat Co., Birmingham, was chairman, and Joe T. Gilbert, Stockham Valves & Fittings Inc., vice chairman of the committee on arrangements. These companies were open for inspection: Alabama By-Products Corp., Tarrant City; Alabama Clay Products Co., Bessemer; American Brake Shoe Co., Southern Wheel Division; American Cast Iron Pipe Co., Anderson Brass Works; W. J. Bullock Co., Continental Gin Co.; Foundry Service Co.; Hill & Griffith Co.; McWane Cast Iron Pipe Co.; Harbison Walker Refractories Co.; Jefferson Foundry Co.; Miller Foundry Co.; National Cast Iron Pipe Co.; Pressure Cast Products Corp.; Southern Car & Mfg. Co.; Sloss-Sheffield Steel & Iron Co.; Stockham Valves & Fittings; Joe Stone Foundry Co., Bessemer; Southern Precision Pattern Works; Thomas Foundries Inc.; Unit Stove & Furnace Co.; Tennessee Coal, Iron & R. R. Co., Ensley; Jackson Industries; U. S. Pipe & Foundry Co.

Chairmen of other conference committees were: Program, C. K. Donoho, American Cast Iron Pipe Co.; entertainment, E. A. Brandler, Electro Metallurgical Division, Union Carbide & Chemical Corp.; publicity, J. P. McClendon, Stockham Valves & Fittings Inc.; membership, Donald C. Abbott, Hill & Griffith Co.; educational, Ray L. Farabee, Central Foundry Co., Holt, Ala.; registration, Jack E. Williams, A. B. C. Coal & Coke Co.; greeters, Fred C. Barbour, McWane Cast Iron Pipe Co. One of the hardest working men was Fred K. Brown, Adams, Rowe & Norman Inc., and secretary of the chapter.

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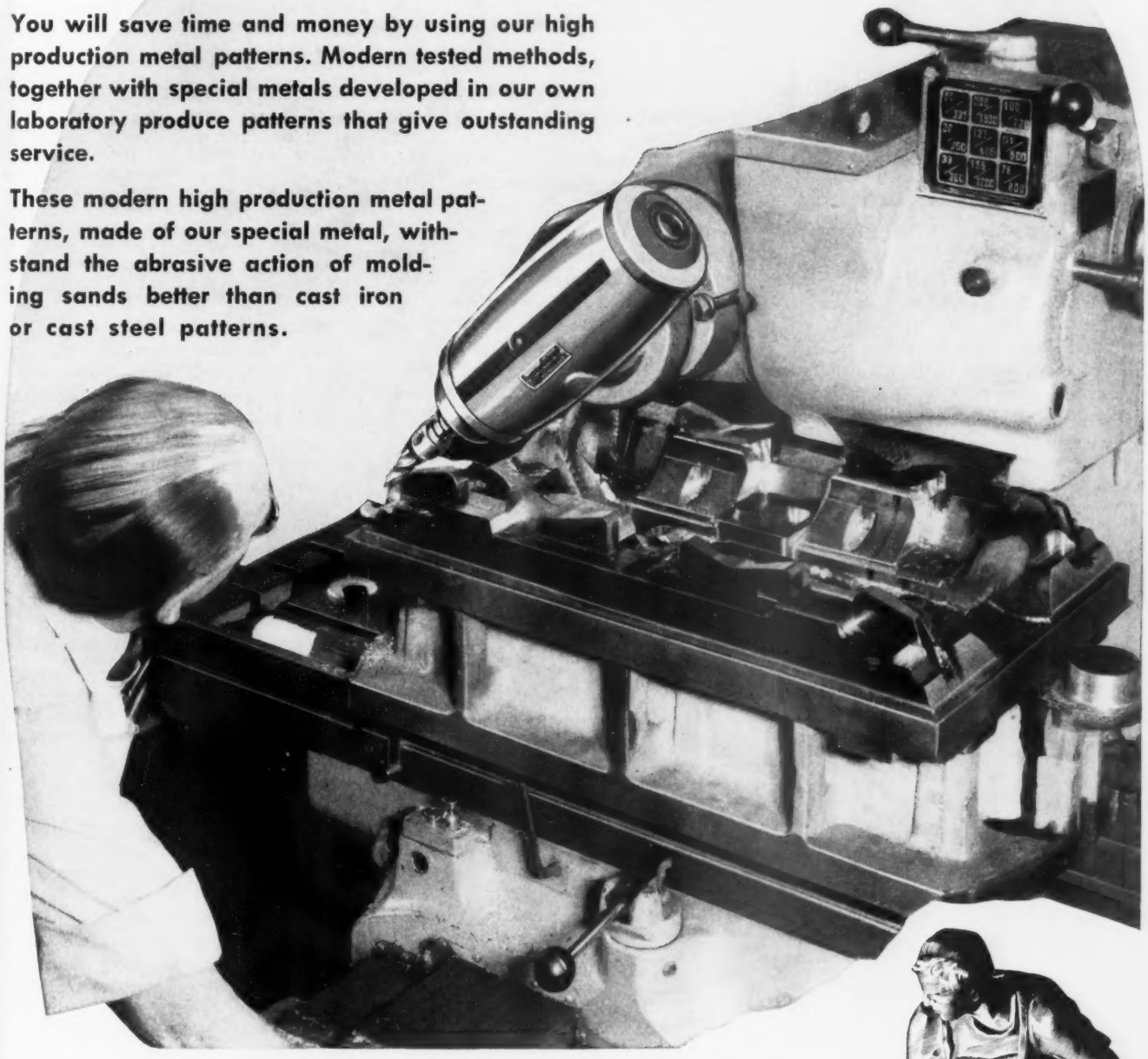
You will save time and money by using our high production metal patterns. Modern tested methods, together with special metals developed in our own laboratory produce patterns that give outstanding service.

These modern high production metal patterns, made of our special metal, withstand the abrasive action of molding sands better than cast iron or cast steel patterns.



PERMANENT MOLDS · WOOD AND METAL PATTERNS · KELLER AND DUPLICATOR WORK · MACHINE WORK · MALLORY METALS BERYLLIUM COPPER · MONEL METAL · EVERDUR CASTINGS COPPER CASTINGS OF HIGHEST ELECTRICAL CONDUCTIVITY · BRASS, BRONZE AND ALUMINUM CASTINGS · ETERNA METAL

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Adventures of BILL

By PAT DWYER

Illustrations by RICHEY

HERE we are," I said to Bill the other night, "slightly more streamlined than we were last fall when we entered the annual marathon with Old Man Winter on our tail and breathing heavily down the back of our neck. With commendable patience, perseverance, integrity and frugality we have won through by the skin of our teeth. Now we can creep out of our igloos occasionally and bask in the rays of the sun. Truly a remarkable achievement."

"Less of the cockadoodledo *if* you please, and where do you get that skin of our teeth stuff? If you ever saw skin on the teeth, any teeth, you have better eyes than I have, young Molar me lad. The silly saying was coined one time by some bird hard pushed to maintain a smarty reputation. It was picked up immediately by a voracious public which never thinks for itself. Today it is as firmly intrenched in the language as any other of the thousands of meaningless catch words and slogans.

"You may consider yourself lucky to have come through the winter all in one piece, but I see no reason for your smug complacency. The annual miracle of the changing seasons has been going on for no one knows how many years, certainly since this old world has been rolling through space, and probably will continue world without end, amen. You never had, have not now and never will have anything to do with it.

"Without benefit of higher education the birds fly south in the fall and north in the spring. I was thinking along that line last night when I saw and heard a flock of wild geese high overhead and heading for the arctic regions after spending a comfortable winter down around the Gulf of Mexico and Central America. Mention of Mexico reminds me I had a letter recently from an old friend who operates a nonferrous foundry down that way south of the Rio Grande. Here I'll read it for you:

Your discourse on methods and equipment employed in casting bronze tablets and presented in a recent issue of FOUNDRY, was of special interest. We make castings of this kind from time to time. Up to the present the largest, and therefore the most difficult, had about 500 letters on the face. I feel legitimately proud of the fact it came out of the mold perfect in every detail. Molds for these castings are skin dried with an oil torch. Metal for the smaller sizes is poured from one ladle. Two ladles are employed to pour metal into the larger sizes.

Several years ago we made tablets for erection on a large steel bridge spanning a certain river and another for a wooden bridge farther down the same river. All three disappeared in a very short time after they were attached to the bridge approach frame. The center of the first mentioned bridge marks the boundary line between two states. The tablet had quite an elaborate inscription, fancy border and names all properly spelled out of all the dignitaries of both states local and national. Not a word about the lads who built the bridge, but nearly all capital letters for the pompous lads who had as much to do with the job and who knew as little about it as the Shah of Persia with his famous wagga-wagga.

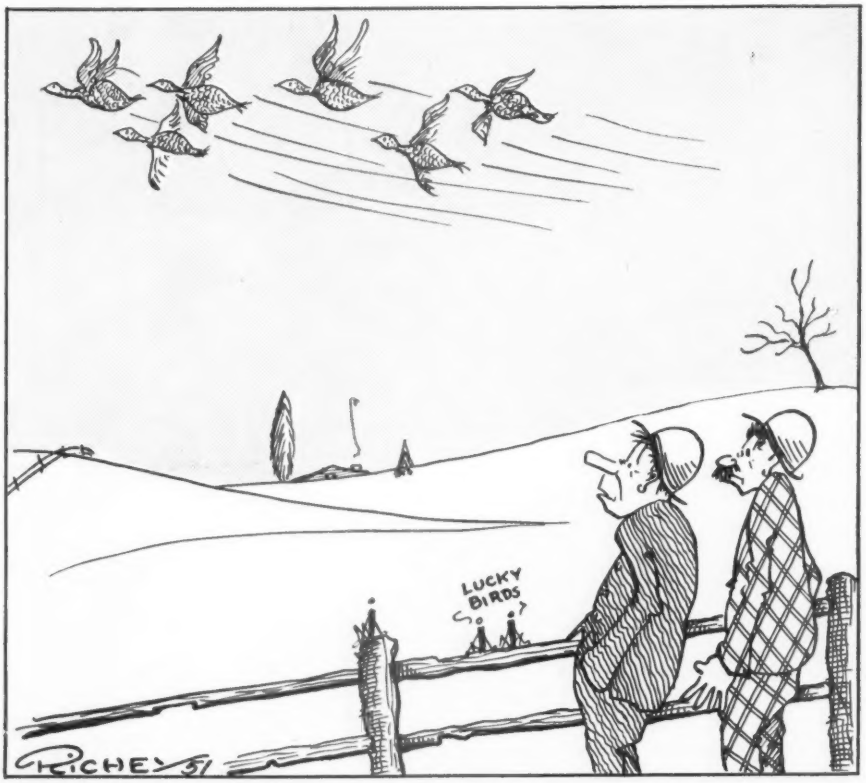
"It is certainly marvelous," Bill paused for brief comment, "the way stray items drift around the world. The last and in fact the only time I ever heard any reference to the magnificent jewels worn by the Shah of Persia was in an eastern foundry where I worked with an old Welsh molder. For my benefit on one occasion he recited a verse composed by a lad in his old home town. Don't ask me the name of the old home town, or how to spell it. The name is nearly as long as your arm and there is not a vowel in it from beginning to end."

"I have seen some of these weird names occasionally. I hope the verse is not built on a similar foundation. If it is you have my gracious permission to skip it and get on with the story. Life is too short to spend it working out impossible puzzles. What about the Shah or, if you prefer, the Shawr and his jewelry display?"

"This versifier, apparently a Stout Fella with little or no respect for royalty, flourished at or about the time the Shah covered with precious stones of all kinds paid a ceremonial visit to Queen Victoria. One special item worth one or two million pounds was known as a wagga-wagga. Mind you, that was at a time when a pound was a pound, almost equal to a five dollar bill.

"To a certain extent the jeweled ornament corresponded to the sporan, part of the tartan costume worn by the well dressed Scottish Highlander. I wonder if any Persians were included in the ranks of the marauders who invaded Britain in the early days. As you might say, on the other hand, did any gallant Highland gentlemen follow the skirling pipes in the days of the old crusaders. Jerusalem, Da-

(*Continued on page* 238)



Little boys are not the only people who have long, long thoughts

It pays to MAINTAIN A *Uniform* CUPOLA DIAMETER...

use *Cupoline*

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● Cupoline burns out slowly because it is a scientifically proportioned refractory which forms a dense, low-clay, low-moisture patch. Slow burn-out means a more uniform diameter, and that means more uniform cupola operation. Uniform operation means hotter iron, uniform melting rate and uniform combustion. All this, at *much* lower costs.

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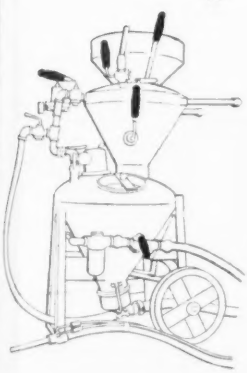

Cupoline Bondact Mix is proportioned for use in the Bondactor Patching Machine. Bondactor makes contour patching simple. The uncertainties of hand mixes are eliminated. The patch contains no joints or points of weakness. Moisture is easily and exactly controlled.

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CORE OILS

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for TECHNICAL BULLETIN-141

Learn how these products, perfected by extensive research and proven on the job in leading foundries, will give you these great advantages:

- **LOWER COST and HIGHER QUALITY**
  —lower baking temperature and shorter baking time—*Increased Production!*
- High green strength—Higher baked strength
- Excellent collapsibility for easy shake-out.
- Smoother cores for better castings
- Excellent performance in either blown or hand-rammed core boxes

There's a PROVEN PELRON CORE OIL FOR EVERY METAL

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(FORMERLY CHEMCO PRODUCTS CO., INC.)

LYONS, ILLINOIS

SALES OFFICES

CHICAGO DETROIT CLEVELAND SOUTH BEND
INDIANAPOLIS MILWAUKEE ROCK ISLAND

(*Continued from page* 236)

mascus and Acre are within a stone throw, well, maybe two Tipperary stone throws from Persia.

"The verse, ingenious in composition but lamentably lacking in respect for those who sit in high places, received wide and hilarious reception, particularly among the lower and middle class inhabitants of the tight little island, including Wales. Slightly changed from the more robust original the neat little four-line job ran as follows: ''Ave ye seen the Shaw? 'Ave ye seen 'is precious daggah? 'Ave ye seen the blinkin' gems that shine on the wagga-wagga?' You will note and admire how cleverly the poet has adapted the spelling of dagger to rhyme with wagga.

"And now of all places the reference turns up in Mexico 80 or 90 years after the poetically minded lad composed the masterpiece. These Welsh molders certainly get around. You find them in almost as many places as the graduates of Glesga', Aberdeen and Dundee."

"Now that you have enjoyed your jaunt through time and space, nearly 100 years of one and 3000 miles of the other, perhaps you might be persuaded to shut off the engine, stick on the brakes and coast down to the landing field where your old friend is reciting some of his adventures. Approaching with hat in hand and bated breath may I inquire Sir if the suggestion meets with your august approval?"

"You can put on the owld caubeen," Bill grinned, "even if it is not the one your father wore in the little isle so green. Le's see. Where did I leave off? Here it is:

All three tablets disappeared in a remarkably short time. Just vanished. One day they were there blinking in the sunlight. Next day they were gone as you might say body and bones. Some time later, to my somewhat mild astonishment, I found the largest one still intact in a load of scrap offered me apparently in good faith by a junk dealer. I told him where the scrap came from and, of course, refused to accept or pay for it. He assured me in the most earnest manner that he immediately would return it to its place on the bridge. Later I was not greatly surprised to learn that the promise was not kept. Later I found a corner of the casting in another load of scrap. The first dealer had sold the casting to another foundry where it had been broken up for melting. Part of it went again to a junk dealer and eventually came back to me. Junk dealers buy everything offered including tablets and grave markers from the cemeteries, brass beds, old Ford radiators, pewter mugs, counterfeit pesos, copper wire, household utensils, tin tags, and tobacco signs. No questions are asked and therefore no stain falls on the pilferer's con-

(*Continued on page* 240)

This Bulletin HAS MANY OF THE ANSWERS TO YOUR QUESTIONS ON Air Cleaning

It Covers:

- AIR POLLUTION CONTROL
- BUFFALO "DC" STATIC WASHERS
- BUFFALO HYDRO VOLUTE SCRUBBERS
- BUFFALO WET GLASS CELL AIR WASHERS
- BUFFALO CUPOLA WASHERS
- BUFFALO GAS SCRUBBERS
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BUFFALO FORGE COMPANY
Buffalo, New York
CANADIAN BLOWER and FORGE CO., LTD., Kitchener, Ont.
BULLETIN 3181-B

Write FOR YOUR COPY!

"Buffalo"

KNOW-HOW IS AT YOUR SERVICE!

Fifty years ago, "Buffalo" Air Washers were solving dust problems for industry. Today our vast background of experience in dust and fume control is at your disposal. Whether your problem is the elimination of a nuisance or air cleaning for process control, "Buffalo" has the equipment and the know-how to help you solve it. Call on us for recommendations.

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VENTILATING FORCED DRAFT | AIR WASHING COOLING | AIR TEMPERING HEATING | INDUCED DRAFT EXHAUSTING PRESSURE BLOWING

(*Continued from page* 238)

science. The dealers make a pious pretense and occasionally go through the public motions of refusing to buy stolen railroad brasses. Nothing is sacred to the *Amantes de lo ajeno* (Lovers of other people's property).

Several years ago the padre of the parroquia brought me a problem. He had a number of small wooden boxes nailed to the wall of his church to receive contributions from the charitably inclined, for distribution later to the deserving poor of the parish. Some members of the congregation, modestly remaining incognito, fell in love with the boxes and carried them away. Either through hurry or oversight they neglected to dump the contents before they fled into the darkness. The padre and I designed a little brass door with a slot fitted in a brass frame and set into the wall. The doors were fitted with flat key drawer locks. The locks were easy picking for the mechanically expert *rateros*. In Mexico City it is claimed that some of the operators are so expert they can take a man's socks off his feet without his knowledge and without removing his shoes.

Later I designed and constructed a number of boxes with locks and Yale style keys. Quite a number were made for local churches and several for churches in Mexico City. Five were installed in a little town not far from here. One day the padre brought back all five, twisted and bent from the enthusiastic application of a chisel or crowbar. Among the burgling fraternity I have been told the tool is known as a jimmy. I wonder if that was the name of the inventor.

"By way of a postscript he wrote that he was expecting an order for several bells, but he was worrying about where he was going to get the necessary copper. By a curious coincidence I had a letter in the same mail from a foundryman who wrote that he would appreciate information on the proper practice to be observed in making copper castings. I wrote him as follows:

"Where conductivity is not the main or governing factor, a casting which contains a small amount of alloying element may be acceptable. This is common practice in foundries engaged in the production of copper castings. Sometimes 1 per cent zinc; sometimes magnesium up to 1 per cent is added. In some instances phosphor-copper is added to make what might be termed phosphor-copper, an alloy of copper and phosphorus with a minimum amount of phosphorus.

"According to opinion expressed by the late Charles Vickers, all these properly handled will produce fairly sound castings. However, the electrical conductivity will be affected materially by the presence of an alloying element. To cast any of these combinations, every precaution should be taken to melt the metal as rapidly as possible and thus prevent the absorption or inclusion of gas. Necessary risers are provided to insure adequate feeding. The metal is poured at a relatively low temperature which has not been exceeded to any great extent during the melting period.

"If high-conductivity copper is a factor in the order and if the necessary production cost is included in the purchase price, some medium must be used to insure the reduction of copper oxide in the molten metal without affecting the conductivity. In the alloys suggested previously metals added to the copper act as deoxidizers. Copper invariably has considerable copper oxide in solution when it arrives from the refinery. The amount may be increased during the melting process in the foundry.

"Suitable method for making a pure, high-conductivity copper casting is to use boron carbide as the deoxidizing agent. The copper is superheated to about 2300° F after the boron carbide has been added. The crucible then is immediately removed from the furnace and allowed to cool by radiation to about 2100° F. At this stage the metal is poured into the

(*Concluded on page* 242)

Need core plates that SPEED PRODUCTION?

. . . then use TRANSITE CORE PLATES that are light-weight and easy to handle

You'll find two important reasons why Transite* Core Plates mean faster production: First, core makers can handle more plates with fewer trips. Second, Transite Core Plates are easier to clean . . . core wash, sand, etc., do not adhere to them as readily as to other core plate materials.

Here are more *reasons why you can profit by using Transite Core Plates:*

They give long service—Made of tough, fibrous asbestos and cement, Transite Core Plates resist shock and corrosion—will not crack or break easily—require little, if any servicing. *Performance records of 8, 10 and 12 years are not unusual.*

They maintain accuracy — Transite Core Plates stay smooth through long, hard service. Foundrymen who have used them for years report minimum warpage.

For cores of large mass and small surface area, perforated Transite Core Plates are also available to eliminate green cores and reduce baking time. For full details write Johns-Manville, Box 290, New York 16, N. Y.

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Johns-Manville TRANSITE CORE PLATES

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SPEED PRODUCTION WITH KRAUSE CEREAL BINDERS

Mix Quicker — Mold Faster
Collapse and shake out in a jiffy

MORE GREEN STRENGTH:

In both green and dry core stages there is greater binding strength with Truscor and Amerikor — they supply the needed green bond and strong affinity between sand granules.

FINER DETAIL:

Smooth surfaces — sharp, unbroken edges — less scabbing, cold shut, buckling — because Truscor and Amerikor are scientifically processed to provide these advantages.

FINE FLOWABILITY AND TEXTURE:

The uniform quality of Truscor and Amerikor insures quicker mix — easier blending — less sticking — uniform ramming — increased permeability.

EASY, BURN-OUT COLLAPSIBILITY:

Because cereal binder burns out rapidly and completely during casting, you are sure of ready collapsibility and easy shake out when you use Truscor or Amerikor.

For better, lower-cost cores, place a trial order for Krause Cereal Binders now — Truscor, if you like a light weight binder; Amerikor, if you prefer a heavier weight. Call any one of the distributors listed below or write us direct. **CHAS. A. KRAUSE MILLING CO., Milwaukee 1, Wisconsin.**

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Carl F. Miller & Co.
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Milwaukee Chaplet & Mfg. Co., Milwaukee 15, Wis.

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Frederic B. Stevens, Inc.
166 Brewery Street
New Haven 11, Connecticut

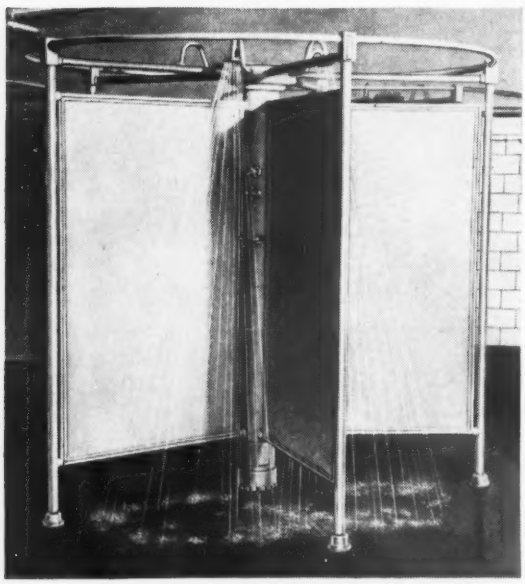
(*Concluded from page* 240)

mold or molds. Other deoxidizing agents available on the market may be used in a similar manner.

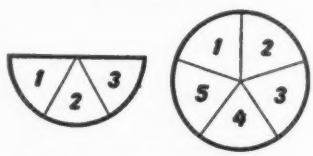
"Ingot casting copper properly deoxidized should yield solid castings. Whether or not commercial copper castings are pure copper or slightly alloyed will depend largely upon the agreement between consumer and producer. In some instances they are pure copper deoxidized with some agent which for all practical purposes is removed during the deoxidizing process. In other cases they may be deoxidized with zinc to the extent of about 2 per cent. To a great extent the zinc remains in the final product. Many deoxidizers are available. Names and addresses of supply sources are presented in the advertising pages of FOUNDRY.

"Copper should be melted fast and hot. Like any other nonferrous metal it should not be left in the furnace subject to attack from the furnace gases. During the pouring period a charcoal covering should be provided. It is not necessary to skim the metal completely. It should remain under the protection of the charcoal, which in turn is held back by the skimmer."

ECONOMICAL SHOWER BATHS



3-Stall and 5-Stall Models



Installed by Elmira Foundry Company

8 Bradley Three-Stall Units

8 Bradley Five-Stall Units

Bradleys Are Multi-Stall Showers That Cut Installation Costs

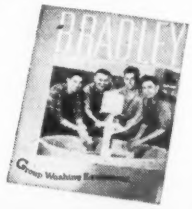
At the Elmira Foundry *16* Bradley Shower installations were made with a capacity of serving 64 individuals simultaneously. A similar set-up of ordinary single-stall showers would have required 64 separate installations. In addition 64 sets of hot and cold water and drain pipes would be required instead of only 16 sets as with Bradley Multi-Stall Showers.

Furthermore, savings are realized in lower water consumption and maintenance. Bradleys are available with or without receptors and can be quickly mounted on any type of floor including wood. The economy and convenience of Bradley Multi-Stalls pay off in dollars and employee goodwill. BRADLEY WASHFOUNTAIN CO., 2217 W. Michigan Street, Milwaukee 1, Wisconsin.

Send for interesting, fact-filled Catalog 4701. Write today.

BRADLEY *multi-stall showers*

Distributed Through Plumbing Wholesalers



Wisconsin Conference

(*Continued from page* 168)

demonstrated that sand can affect shrinkage. An excellent movie of the experiments, filmed by Bradley H. Booth, foundry engineer, Carpenter Bros., Milwaukee, and numerous slides provided convincing proof of Mr. Sanders' contention. Molds used in the tests were made from fire-clay sand, southern bentonite and western bentonite. Shrinkage decreased when 2, 4 and 6 per cent of seacoal was introduced and the same results were obtained when 1, 2 and 3 per cent wood flour was put in the sand.

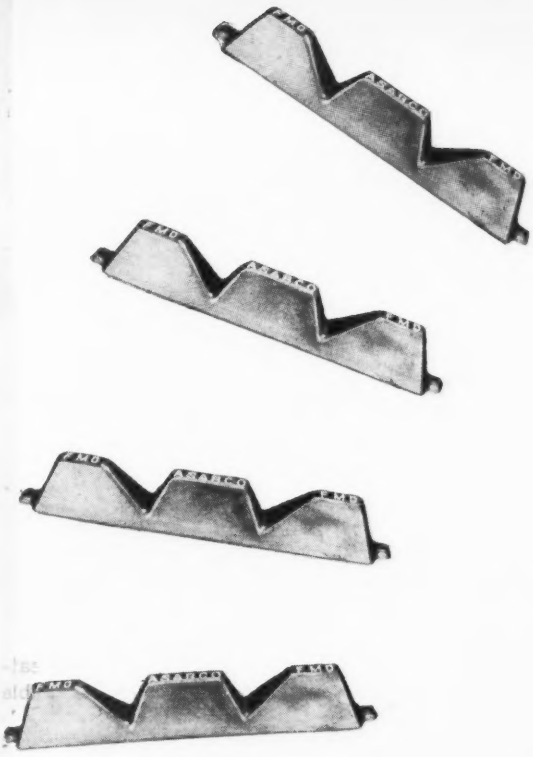
Final session on Malleable Iron was held under the direction of H. C. Stone, Belle City Malleable Casting Co., Racine, Wis., and Ralph H. Schaper, Wisconsin Appleton Co., Milwaukee. Prof. Richard Schneidewind, University of Michigan, Ann Arbor, Mich., led a discussion on heat treatment and properties of malleable iron. He pointed out that with knowledge of the composition of one malleable iron, and its response to a given heat treating cycle, it is not difficult to determine a suitable cycle for another iron of different composition. Formulas on the effect the different elements are available to ascertain the changes in the cycle and Prof. Schneidewind showed their application. He also described briefly the several procedures for making pearlitic malleable iron and how the structures differ according to the method.

Sort the Scrap

"Cupola Operation with High Scrap Mixture" was discussed by A. J. Busch, vice president, Charles C. Kawin Co., Chicago, in the first Gray Iron session. Because foundries are forced to lean more heavily on scrap as pig iron shortage grows more acute, the speaker pointed out the damage to castings which can result from contaminations in the scrap. The foundrymen, he declared, can well afford to sort scrap before charging it. Some attention was devoted by the speaker to the basic-lined cupola and its operation. Leo B. Koenik, superintendent, J. I. Case Co., Racine, Wis., was chairman of this session, and A. R. Janes Jr., Standard Foundry Co., Racine, was co-chairman.

"Fluidity Testing of Gray Cast Iron" was discussed at the second Gray Iron session by Prof. Philip C. Rosenthal, University of Wisconsin, with Harold Sohner, International Harvester Co., and Walter Vierthaler, Iroquois Foundry Co., as chairmen.

(*Continued on page* 244)



...OU and the Aluminum Situation

Once again foundries find it difficult to get exactly the aluminum alloys they want when they want them.The reasons for this are well known. Aluminum is a critical material and must go first where it is needed most.

Maybe you can help yourself in this situation . . . ask Federated for recommendations on alloys you can use successfully in place of your first choice. Often this means an even better casting, because new alloys and techniques are constantly being developed.

For example, Federated metallurgists were called to the Racine Tool and Machine Company, Racine, Wisconsin, where available aluminum alloys just wouldn't deliver the required combination of impact strength, yield strength and proportional limit in a Rail Tie-Tamper casting. Result: a new alloy was created and the casting met specifications.

The same expert service and research . . . available to all foundries . . . are especially valuable now when problems are more numerous.

As far as supplies are concerned, all we can say is that Federated is mobilized, too. More and more metal flows out of Federated's 13 plants every day. Often it is not enough and often we are not free to distribute it at will. D.O.'s come first and no-one will dispute this necessity.

For technical and practical metallurgical help in solving aluminum alloy problems . . . and in conserving critical materials . . . write Federated, Department E.

Federated Metals Division

Federated first in the non-ferrous field FMD

AMERICAN SMELTING AND REFINING COMPANY • 120 BROADWAY, NEW YORK 5, N.Y.

(*Continued from page* 242)

Describing tests to determine the effects of metal composition and temperature on fluidity, the paper pointed out that carbon is the most effective element in increasing fluidity, being twice as influential as phosphorus and four times that of silicon. Manganese has a slightly retarding effect.

How sand defects contribute to scrap castings was described by George Anselman, Beloit Foundry Co., Beloit, Wis., at the third Gray Iron session. It was presided over by Harry Johnson, Walter Gerlinger Inc., and George Antonic, Motor Castings Inc. This subject was discussed under the general headings of blows, hot tears and cracks, cuts and washes, erosion and expansion scabs, metal penetration, fusion, swells, rattails, drops, stickers and pin holes. Slides were shown to illustrate the principal types of defects.

E. E. Ballard, Lester B. Knight & Associates, Chicago, spoke at the concluding Gray Iron session. Meeting had as chairmen Leslie Woehlke, Grede Foundries Inc., Milwaukee, and Clifford Schwenn, Brillion Iron Works, Brillion, Wis. Mr. Ballard discussed design, operation and maintenance of the modern foundry, and stated that design is not a simple matter since many factors must be considered. Before any modernization is undertaken surveys should be made of all operations and equipment to determine what improvement can be made, and how it can be accomplished. Modernization can be done over a period of time if funds are not available to carry on the complete program, and in that case the starting point is where the greatest benefit will be obtained. Savings developed then can be applied to other portions of the program in order of importance.

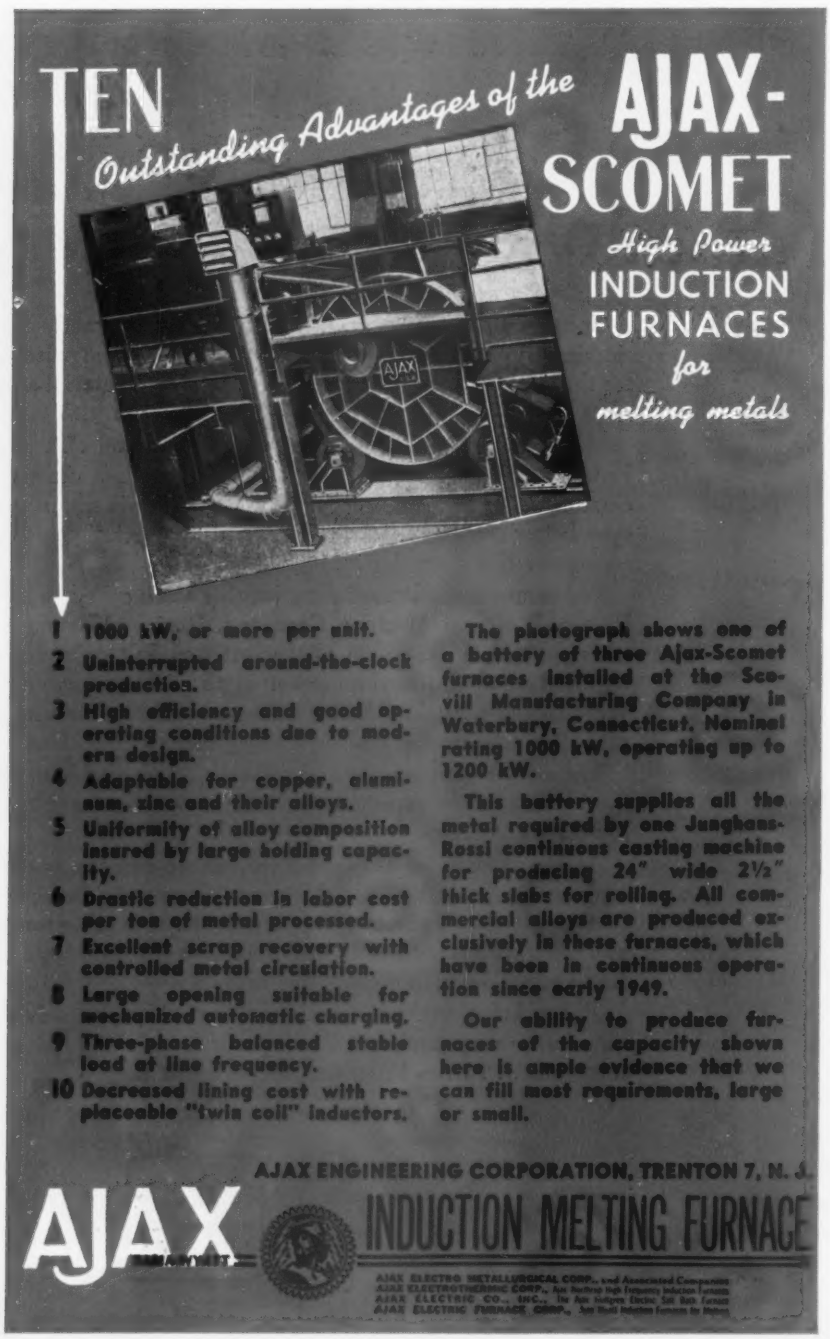
John F. Klement, chief metallurgist, Ampco Metal Inc., Milwaukee, presented an evaluation of the "Croning Molding Process" at the opening Pattern session. Chairman was W. Kollmorgen, owner, Kollmorgen Pattern Works, Milwaukee, and A. M. Fischer, vice president, Charles Jurack Co., Milwaukee, was co-chairman. The speaker described the technique which utilizes sand and resin shells to form mold cavities and reviewed experimental work pursued by his company. Metal patterns are used. Advantages and disadvantages of the process were enumerated. While the method holds considerable promise for high-volume production of a given casting, Mr. Klement asserted, cost of equipment to mechanize the operation is disproportionately high.

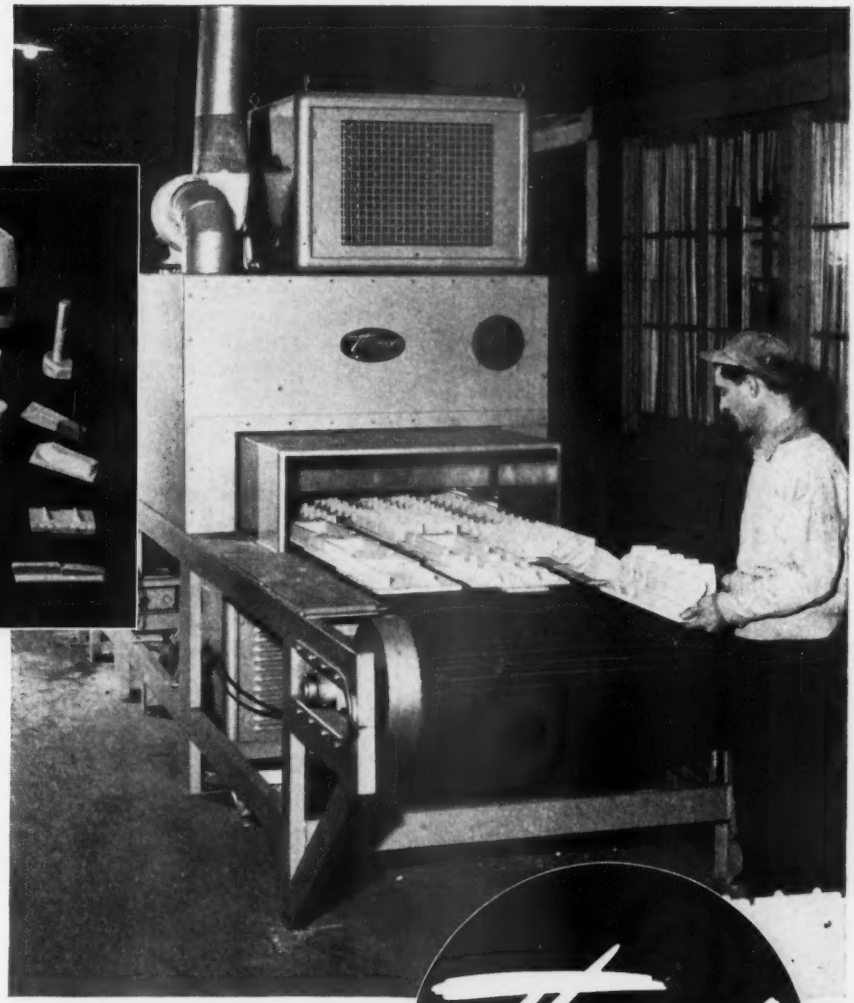
Discuss Pattern Equipment

"The Foundryman's Attitude Toward Pattern Equipment" was discussed by George P. Antonic, superintendent, Motor Castings Co., Milwaukee, at the second Pattern session. Harry Arneson, president, Spring City Pattern Works, Waukesha, Wis., served as chairman, and J. Anderes, Belle City Malleable Iron Co., Racine, Wis., was co-chairman. In the opinion of the speaker, pattern shops do not have adequate cost accounting and estimating is not what it should be. Discussion in the session developed that it is sometimes best to take the highest bid on patterns. This is better than accepting the lowest and then being asked for more money for completion of acceptable patterns.

At the third Pattern session, with M. Frankard, Delta Mfg. Co., Milwaukee, and A. F. Pfeiffer, Allis-Chalmers Mfg. Co., West Allis, Wis., presiding, the value of the pattern engineer to modern casting engineering was discussed by Peter Butzin, Delta Mfg. Co. He pointed out that

(*Continued on page* 246)


TEN
Outstanding Advantages of the
AJAX-SCOMET
High Power
INDUCTION FURNACES
for
melting metals
1 1000 kW, or more per unit.
2 Uninterrupted around-the-clock production.
3 High efficiency and good operating conditions due to modern design.
4 Adaptable for copper, aluminum, zinc and their alloys.
5 Uniformity of alloy composition insured by large holding capacity.
6 Drastic reduction in labor cost per ton of metal processed.
7 Excellent scrap recovery with controlled metal circulation.
8 Large opening suitable for mechanized automatic charging.
9 Three-phase balanced stable load at line frequency.
10 Decreased lining cost with replaceable "twin coil" inductors.
The photograph shows one of a battery of three Ajax-Scomet furnaces installed at the Scovill Manufacturing Company in Waterbury, Connecticut. Nominal rating 1000 kW, operating up to 1200 kW.
This battery supplies all the metal required by one Junghans-Rossi continuous casting machine for producing 24" wide 2½" thick slabs for rolling. All commercial alloys are produced exclusively in these furnaces, which have been in continuous operation since early 1949.
Our ability to produce furnaces of the capacity shown here is ample evidence that we can fill most requirements, large or small.
AJAX ENGINEERING CORPORATION, TRENTON 7, N. J.
AJAX
INDUCTION MELTING FURNACE



Moline Malleable now makes larger and more complex cores with THERMEX *Core-baking Equipment than were possible with their former equipment. This progressive company reports that* THERMEX *Core-baking Equipment "brings about the most important improvement in core-baking operations in years."*

"pays for itself in less than a year"

—MOLINE MALLEABLE IRON CO.

Thermex
ELECTRONIC CORE-BAKING EQUIPMENT

A partial list of companies who have purchased THERMEX Electronic Core-baking Equipment

American Hardware Corp.
Brugger Manufacturing Co.
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Phoenix Brass Fittings Corp.
Ronci Company
Sterling Faucet Company
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United States Pipe & Foundry Co.

"WE ESTIMATE," states Moline Malleable Iron Co. of St. Charles, Ill., "that our new THERMEX Core-baking Equipment will pay for itself in less than a year. We have just placed an order for a second THERMEX installation." Here's why:

- **Labor costs have been cut drastically, in the baking department, and in the core-making department as well.**
- **Utility costs per ton of sand have been cut more than 50%.**
- **Only one-fourth the floor space of conventional baking equipment is needed —freeing this space for other work.**
- **Core rejects have been reduced 66%.**

Why not take advantage of the labor-saving, cost-cutting advantages of THERMEX Core-baking Equipment? Girdler manufactures dielectric core-baking equipment in capacities from ½ ton to 15 tons per hour. For complete data write The Girdler Corporation, Thermex Division, Louisville, Kentucky.

THERMEX—T. M. Reg. U. S. Pat. Off.

THE GIRDLER CORPORATION
Thermex Division

(*Continued from page* 244)
the pattern engineer is an individual who is fully conversant with all phases of patternmaking, foundry practice, and machine shop practice, and applies that knowledge to produce the best casting most economically. In his firm, which purchases all its castings, the pattern engineer surveys the foundry which is to produce the castings to determine equipment available and practices employed. With that information he then works with the casting designer and patternmaker to supply suitable pattern equipment. Mr. Butzin described in detail how the various steps are carried out.

The concluding Pattern session comprised a demonstration of drag and cope dual production as developed by Allis-Chalmers Mfg. Co. A. F. Pfeiffer of that company was the speaker and meeting chairmen were A. M. Fischer, Charles Jurack Co., and W. Kollmorgen, Kollmorgen Pattern Works. The practice discussed consists of doubling production on certain types of castings which normally would have the pattern mounted on one side of the matchplate and the mold cavity only in the drag. By mounting patterns on both sides of the plate production is doubled. A split core is used between cope and drag.

The first of four sessions devoted to steel castings had J. B. Caine, consultant, Cincinnati, as speaker, with G. V. Jedniak, Sivyer Steel Casting Co., and O. H. Kraft, Bucyrus-Erie Co., as chairmen. Mr. Caine presented an interesting discussion of various factors connected with the design and use of gates and risers.

Metal penetration was illustrated and discussed at the second Steel session by S. L. Gertsman, Department of Mines and Technical Survey, Physical Metallurgy Division, Ottawa, Canada. W. Punko, Wehr Steel Co., and P. C. Fuerst, Falk Corp., were meeting chairmen. Mr. Gertsman showed examples of penetration on various types of castings and the effects of changes in molding sand composition, metal head or pressure and temperature and core washes. As preventives, he recommended: Relatively low pouring temperature; adequate ramming; use of fine grain sand or silica flour and an effective wash, carefully dried.

Sand Is Poor Cover

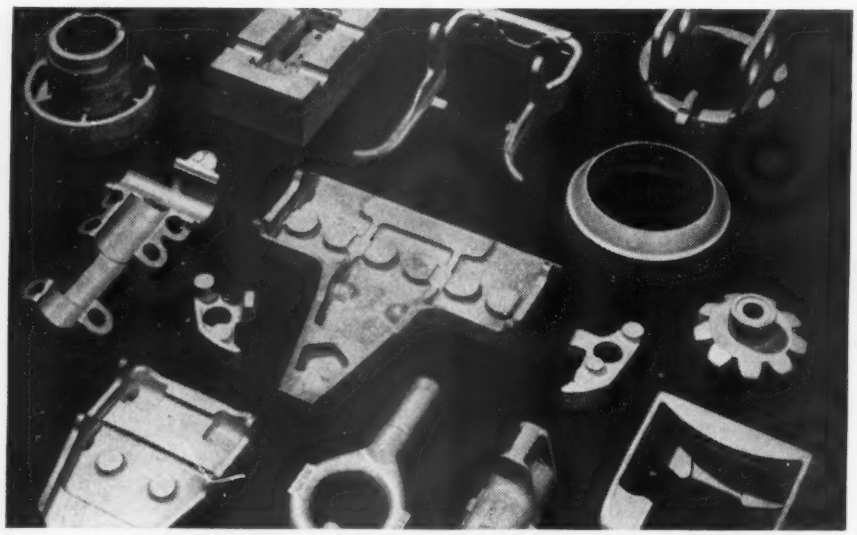
A comprehensive discussion of riser insulation and compounds was given at the third Steel session by Prof. Howard F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass. G. E. Schneider, Grede Foundries Inc., and H. A. Ziebell, Crucible Steel Casting Co., were meeting chairmen. Prof. Taylor emphasized that it is useless to keep the riser fluid if its junction with the casting freezes. He discouraged use of sand on top the riser because it extracts heat from the metal. Substitute materials are combustiles such as rice hulls or shavings, carbonaceous materials such as Mexican graphite; exothermic compounds like iron oxide and clay, or highly exothermic products which deposit molten metal.

The fourth and concluding steel session heard John D. Wozny, research metallurgist, American Steel Foundries, East Chicago, Ind., discuss "Repair Welding of Steel Castings." Chairman was A. M. Herrmann, Racine Steel Castings Co., Racine, Wis., and V. E. Ziemer, superintendent, Maynard Electric Steel Casting Co., Milwaukee, was co-chairman. With demand for higher strength and better quality of structure, the company with which the speaker is associated undertook an exhaustive investigation of welding

(*Concluded on page* 248)

BERYLCO BERYLLIUM COPPER CASTING ALLOYS

offer excellent castability . . . ease and economy of handling



By virtue of its excellent fluidity, Berylco provides maximum detail, smooth surfaces, good dimensional control, and uniformity over long runs with minimum machining. Its low pouring temperature simplifies foundry procedures.

Age-hardened castings of Berylco beryllium copper deliver tensile strength to 170,000 psi, or hardness to 450 Brinell, or conductivity as high as 50 percent. Parts cast of this versatile alloy are finding increased use in such important fields as heavy electrical, communications, electronics, instrument, aviation, machine tool and resistance welding.

Our casting specialists will be glad to consult with you on any of your foundry problems. Write today.

Send for your free copy of this helpful bulletin, "Designing with Beryllium Copper Casting Alloys."

BERYLCO IS AVAILABLE IN 5 LB., 2½ LB. and 3 OZ. INGOTS

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For Intricate Aircraft Castings

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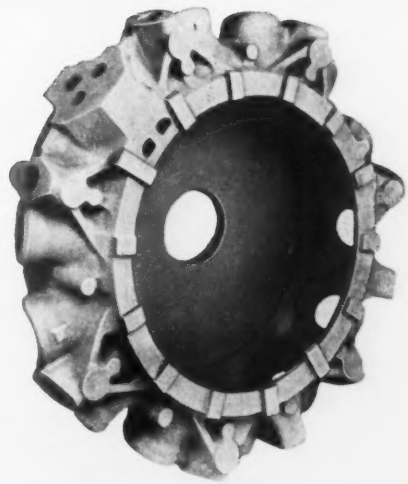
The UNIVERSAL FOUNDRY SAND



Juniata bank sands are more than proving all performance claims both for cores and molds in leading nonferrous, gray iron and malleable foundries throughout the United States and Canada.

IN MOLDS:	IN CORES:
Highly Refractory	Free Flowing
Permits Hard Ramming	Saves Binders
Gives Sharper Profile	Resists Sagging
Bonds Adhere Readily	Smoother Surface
Ideal Facing Sand Base	Highly Permeable
Rapid Mixing or Mulling	No Metal Penetration
Uniform Grain Distribution	No Clay or Lime Defects

Juniata bank sand has the required qualities and right grain pattern for the "C" PROCESS. It has taken an important place in this new field.

Great Lakes are producing artificially-dried, carefully screened sand from two separate deposits ranging from 85 to 110 A.F.A. Grain fineness.

Great Lakes
FOUNDRY SAND COMPANY—DETROIT
MINERS • PROCESSORS • FOUNDRY, METALLURGICAL AND SAND BLAST SERVICE

FOUNDRY SANDS • SILICA SANDS
SHOT—GRIT—BLAST SANDS
REFRACTORIES • BENTONITE
RE-BONDING CLAYS

(*Concluded from page* 246)

procedures and electrodes for various types of steel.

In the tests, it was first necessary to standardize welding procedure. According to Mr. Wozny, only certain types of electrodes were found suitable and the investigation was limited to these. As a result of the research, the company adopted standards for electrodes. The speaker commented that some differences were found in shop welding compared with laboratory work. This was found due to the normalizing procedure.

Malleable Founders Plan Marketing Conference

Malleable Founders' Society will hold its second Market Development —Mobilization Conference at Rensselaer Polytechnic Institute, Troy, N. Y., Apr. 19-20, according to a recent announcement by Lowell D. Ryan, managing director.

The program will be similar to that presented at the first conference held at Northwestern University last year, although more emphasis will be placed on current problems arising from the mobilization program, including regulations of interest to salesmen, material specifications, and methods of procurement. A preliminary announcement of the program will be sent to society membership shortly.

Roy Hobson, assistant to the vice president in charge of sales, National Malleable & Steel Castings Co., Cleveland, is chairman of the Market Development Committee, and will preside at the conference. Charles M. Brennan Jr., president, New Haven Malleable Iron Co., New Haven Conn., and T. A. Scanlan, director of sales, Eastern Malleable Iron Co., Naugatuck, Conn., are serving on a subcommittee to arrange the conference program.

Headquarters for those attending the meeting will be the Hendrick Hudson Hotel, Troy.

Course In Management Offered at Iowa

College of Engineering, State University of Iowa, is offering the twelfth summer management course June 11-23 in Iowa City.

It is an intensive course for factory managers, foremen, industrial engineers, methods and time study analysts, cost accountants and office executives. The course covers production planning, job evaluation, motion and time study, wage incentives, plant layout, quality control, supervisory training, labor relations and legislation, organization and policy, and public speaking.

The regular university teaching staff will be augmented by outstanding men from a variety of industries and other educational institutions. Communications concerning the course should be sent to J. Wayne Deegan, 122 Engineering Bldg., State University of Iowa, Iowa City, Iowa.

Book Review

Engineering Management, reprinted from ***Machine Design,*** paper, 203 pages, 5 x 7 in., published by Penton Publishing Co., Cleveland 13. Price $1.

In recent years the magazine, *Machine Design,* has devoted a considerable number of pages to adequate, up-to-the-minute appraisals of various aspects of engineering management. Because response to these articles has been encouraging, the most pertinent and useful articles have been brought together in this book to provide a convenient reference manual for the development of improved management in the engineering department.

THE TEST THAT PROVES IT BEST!
27"
29½
48"
54"
Buckeye Silica Firestone is the best refractory for lining cupolas . . . the above test is one of many that prove it!
The diagram shows a test that was made by a large foundry to compare the refractory efficiency of Buckeye Silica Firestone with the manufactured material this foundry had used for years.
One-half of the melting zone of the cupola was lined with Buckeye Silica Firestone, the other half with the other material. Under identical conditions, the Buckeye Silica Firestone burned only to a depth of three inches while the daily patch of the other material burned completely through as well as one inch of the backing next to the shell.
Next time, line your cupola with Buckeye Silica Firestone . . . its simplicity of use, superior refractory qualities, longer life, and definite contribution to scientific cupola control have influenced foundries all over the country to adopt it as standard.
Your requirements can quickly be determined by our service department. No obligation. Write today.
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SILICA FIRESTONE

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ELECTROMET Data Sheet

A Digest of the Production, Properties, and Uses of Steels and Other Metals

Published by Electro Metallurgical Company, a Division of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. • In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

High-Chromium, High-Carbon Iron

. . . the Iron That Hardens as it Wears

In many applications involving extreme abrasion, ordinary work-hardening alloys are not suitable. This is because most of these alloys require a definite pounding action for a martensite transformation, and the scouring action of an abrasive is not sufficient for development of high wear resistance. For this reason, high-chromium, high-carbon irons were developed — irons that wear-harden.

Chromium Content of Irons Ranges from 24 to 30 Per Cent

These irons are made in the electric furnace and have the following composition range:

Chromium	24 to 30 per cent
Carbon	2.25 to 2.85 per cent
Manganese	0.50 to 1.25 per cent
Silicon	0.50 to 1.50 per cent
Nickel	minimum
Iron	balance

Irons of this composition are readily castable by steel casting techniques.

Development of Greater Wear Resistance by Heat Treatment

Structurally, these irons consist of primary iron-chromium carbides in a matrix of iron-chromium solid solution and secondary iron-chromium carbides. They are hard in the as-cast condition (500 to 550 Brinell), but when they are given an austenitization heat-treatment they develop much higher hardness (about 600 Brinell), and also have greatly improved wear resistance. Austenitization consists of heating these irons to a temperature of about 2012 deg. F. for an hour, then allowing them to cool in air. This heat-treatment promotes the formation of very unstable austenite—austenite that will transform to a harder martensitic end-product even under rubbing or mild impingement action. Austenitization has been found to be far more effective in increasing wear resistance than the promotion of unstable austenite by the addition of ferrite-forming alloying elements.

High-chromium, high-carbon irons can also be annealed to sufficiently low-hardness values for grinding or simple machining. Hardnesses as low as 350 to 450 Brinell can be obtained by heating the castings to temperatures of 1400 to 1450 deg. F. for 12 to 24 hours, then allowing them to cool in air.

Irons Have Wear Resistance Many Times That of Other Alloys

Austenitized high-chromium irons have been known to last as much as 21 times longer than other wear-resistant alloys in applications involving extreme frictional abrasion. These applications include sand-blast nozzles and liners, pantograph contact shoes, grinding disks, pulleys, chute-liner plates, dredge-pump liners, and rollers for crushing various hard materials.

In a recent test, high-chromium iron was compared to special wear-resistant steel castings as the material for hammers in a machine that was used to crush abrasive material. The chrome-iron hammers were found to have almost 7 times the wear resistance of the steel castings.

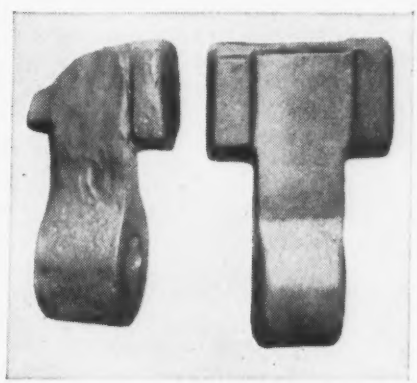


Fig. 1. After crushing the same amount of abrasive material in a hammer mill, the badly worn steel casting (left) had a weight loss of 37 per cent while the high-chromium iron casting (right) lost only 5.5 per cent.

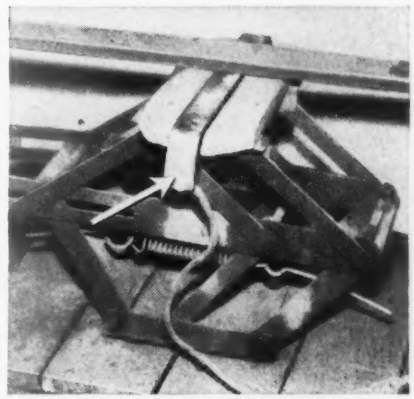


Fig. 2. This chrome-iron pantograph shoe had a service life of about 10 years. A tool steel that was used in similar service wore out in about 3 or 4 months; copper lasted about 24 hours.

When thoroughly backed up with zinc, the iron also has enough shock resistance to be used effectively as crushing hammers and jaw plates for many severe rock-handling jobs.

Metallurgical Service Available

For years, ELECTROMET high-carbon ferrochrome has been used to make chromium additions to abrasion-resistant high-chromium irons. If you should have any questions about either the production or use of these irons, write to the nearest ELECTROMET office. Our metallurgists will be glad to give many valuable suggestions and recommendations on how to make or use this iron most effectively.

Write for a free copy of the ELECTROMET publication, "Abrasion-Resistant High-Chromium Iron." This booklet is a collection of some of the best available information on how to make and to use abrasion-resistant iron castings most efficiently.

The term "Electromet" is a registered trademark of Union Carbide and Carbon Corporation.

New EQUIPMENT *and Supplies*

(1)—Belt: United States Rubber Co., Rockefeller Center, New York 20—Rubber and fabric belt with teeth is said to be capable of speeds to 16,000 fpm with no slippage. Additional claims are that it permits split-second precision timing, operates quietly, will not stretch, and will operate on fixed centers without take-up adjustments. Since it needs no initial tension it has high efficiency with low bearing pressure. Belt requires no lubrication. However, oil will not harm it. Speed ratios up to 30:1 are possible with it. It can be manufactured in any desired size and in a variety of materials to suit specific applications. Belt can be used as a functional part such as a synchronized conveyor as well as for transmitting power.

(2)—Barrow: American Conveyor Co., 1115 West Adams St., Chicago 7—Pneumatic-tire equipped barrow with capacity of 12 cu ft or 1800 lb is said to be easy to handle when fully loaded. It is said to be well balanced and will not tip. It requires no lifting to discharge load. Made of heavy gage steel, the barrow has the following specifications: Top body length, 42 in.; body depth, 36 in.; body width, 21 in.; maximum height from floor, 48 in. It is made in two models—one that tips forward to unloading and one that has discharge gate at the bottom of the sloping front side. Gate is released from back of barrow by a catch.

(3)—Wheel Bushings: Norton Co., 303 New Bond St., Worcester 6, Mass.—Precision bushings for grinding wheels are pressed into the wheel and are said to have a number of features. Of light weight and uniform size, the bushings preserve the inherent balance of grinding wheels. Also consistent hole size is maintained from wheel to wheel with consequent uniform mounting conditions for the user. The bushings are being used in the company's straight wheels, 5 to 8 in. in diam and will be used on wheels of other shapes and sizes in the future.

(4)—Hoist: Robbins & Myers Inc., 1345 Lagonda Ave., Springfield, O.—Electric chain hoist, available in ¼, ½, and 1 ton capacities, is equipped with simple rope controls. Although designed for hook suspension, it is adaptable for trolley mounting. Hoist is constructed of cast aluminum with heat treated gearing and high carbon or alloy steel ground shafts and precision ball bearings. Gear train is enclosed in an air-tight case and operates in an oil bath.

Fire Protection: Ansul Chemical Co., Marinette, Wis.—Dry chemical piped system, designed for automatic protection of industrial fire hazards, is operated by a heat-actuated device. When fire starts and temperature increases, air expands within the device, and trips a nitrogen cylinder release, pressurizing the dry chemical container. Dry chemical then is discharged through strategically located distribution heads onto the fire area. Automatic controls can be added to the system to close doors, windows, ventilation ducts and to operate valves on pipes carrying flammable liquids. Electric controls can be included to shut off

2

3

4

motors and fans, sound alarms and transmit signals to central stations or fire alarm headquarters. Manual as well as automatic operation is provided in all installations.

Floor Resurfacing: Monroe Co., 10703 Quebec St., Cleveland 6—Improved resurfacing and patching material for concrete floors contains a new aggregate said to be effective as an overall floor resurfacer and to fill minute cracks in concrete floors. The basic patch material is a dry cementatious type powder made up of pulverized pure-oxidizing metal grains and four different kinds of aggregate, chemicals and puzzolanic (setting agent) ingredients. The new aggregate consists of approximately 98 per cent oxide basilican, iron, and aluminum. These combine to produce a surface with good resistance to wear, acid, oils and moisture. Shipped as a dry powder, the material is mixed with water and applied in much the same manner as concrete. It is said to bond well to old concrete surfaces.

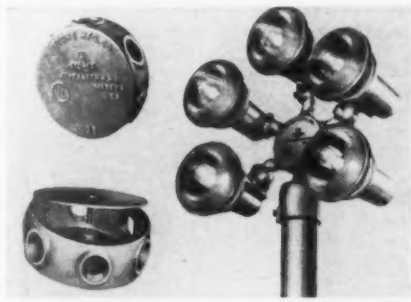
Blast Cleaning: Pangborn Corp., 1400 Pangborn Blvd., Hagerstown, Md.—Liquid blast cleaning unit operates from either a ¼-in. compressed air line or any bottle of compressed gas, and has a blast chamber 15 in. in diam. It uses a wide range of abrasives (as fine as 5000 mesh) and is said to hold tolerances on blasted parts to within 0.0001-in. Unit requires 110-v ac to drive its filter and dust bag motor; consumes from 5 to 20 cfm of air at 80 psi, depending upon nozzle size; and is provided with a chamber light, right and left hand holes, a quick-opening valve for knee or leg operation, and an observation window protected from splash and dirt by a cross-current of fresh inlet air. The abrasive-liquid mixture is slurried in a clear glass bowl of ½-gal capacity at the base of the unit. Two sizes of suction type blast nozzles may be had, the airstream and abrasive-stream port sizes being 1/16-in. and ⅛-in, or ⅛-in. and ¼-in., respectively.

Finish: Midland Industrial Finishes Co., East Water St., Waukegan, Ill.—Heat-resistant finish which may be applied by brushing, spraying or dipping is formulated from a silicone base. It is said to have good stability at 1000° F. Among suggested uses are surface protection of industrial furnaces, heating units, and high-temperature processing equipment.

Sand Washer: Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4—Sand washer may be used with a graduated beaker, No. 570 wash bottle with a removable bottom, or a wide mouth fruit jar. A vibration-proof gasket separates the stirrer from the glassware. Syphon tube is adjustable so that the correct amount of water may be drawn off with any type of bottle.

Pyrometer Equipment: General Electric Co., Schenectady 5, N. Y.—Pyrometer equipment is designed to offer accurate temperature indications, close temperature control of industrial processes and protection for furnaces, ovens and kilns. The complete line consists of flush or surface mounted indicators, controllers and protectors. Instruments have a calibrated accuracy within ¾ of 1 per cent of full scale. A legible 7-in. scale indicates any change in temperature equivalent to 1/10 of 1 per cent of full scale. Immediate control action follows. Normal changes in humidity, ambient temperature and voltage have little or no effect on the exactness of the control action.

Cluster Lights: Stone Mfg. Co., 489 Henry St., Elizabeth 4, N. J.—Weatherproof lights for outdoor lighting are grouped around a cluster box of die-cast aluminum alloy. A removable cast aluminum cover plate sealed with a heavy cork gasket provides access to inside wiring and speeds up installation and the addition of supplementary lampholders. Each box has six holes tapped to take from one to five standard lampholders for the 150, 200, and 300-w outdoor weatherproof reflector bulbs.



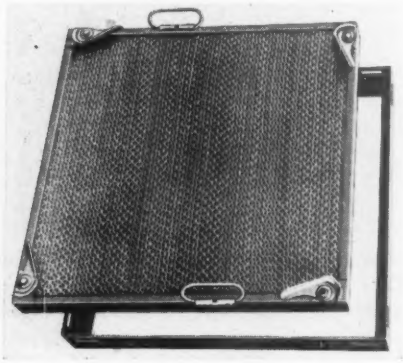
Sealing Castings: Tincher Products Co., 840 Borden Ave., Sycamore, Ill.—Impregnating equipment for sealing porosity in small pressure castings is designed for smaller foundries and manufacturers. It is claimed that an impregnated casting will withstand any pressure, temperature and chemical condition for which the part was designed, and that it will remain pressure tight. Both ferrous and nonferrous castings may be sealed by the process. Further claims are that the sealant is noninflammable, nontoxic and noninjurious to the skin. No dangerous solvents are necessary.

Fire Detector: Fireye Corp., 77 Broadway, Cambridge 42, Mass.—Fire detection system is based on the photoelectric principle and is capable of detecting a very small fire, yet is designed to ignore extraneous light of any intensity, such as the sun or artificial illumination. A protection block, consisting of six detectors and one control panel, provides coverage up to 10,000 sq ft since each detector will monitor any area within a radius of 20 ft. For areas larger than this, combinations of protection blocks may be used.

Aluminum Paint: Speco Inc., 7308 Associate Ave., Cleveland 9—Heat-resistant aluminum paint formulated to withstand temperatures up to 1700°F utilizes a silicone base and is said to fuse with surface metal immediately upon application. It is reputed to form a bright, elastic finish

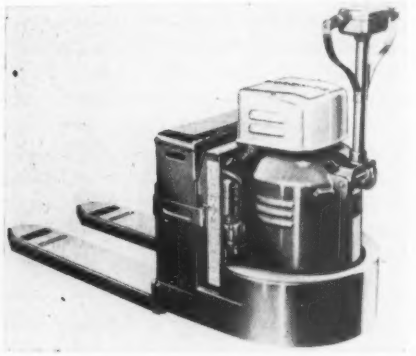
resistant to moisture, corrosion, mild acids, alkalis, and industrial fumes. It sets in four hours and dries completely overnight on hot surfaces.

Air Filter: American Air Filter Co., 266 Central Ave., Louisville 8—High-velocity unit air filter is made of corrugated strips of fine mesh wire in which the corrugations taper



so that when two strips are placed together they form a series of pyramid-shaped pockets. The small ends of the pockets are closed to the air flow to eliminate any open air passages through the media. Filters are designed to operate at velocities up to 500 fpm and maintain uniformly high cleaning efficiency over a wide range of air velocities. They can be serviced in the conventional way with washing and charging tanks or reconditioned by washing out the accumulated dust with a hose and spraying with filter adhesive.

Pallet Truck: Towmotor Corp., 1226 East 152nd St., Cleveland 10—Electric truck is designed to handle pallet loads weighing up to 4000 lb. Improved over former models the truck has a new contactor panel, positive action brake with dead man control, improved differential action, and all-rubber, dual trailer wheels



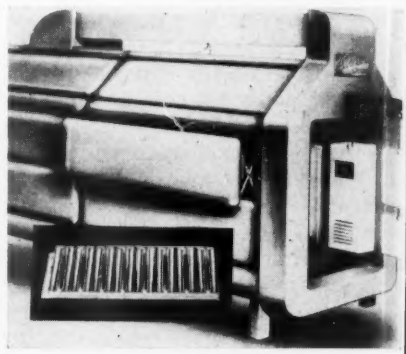
for smooth operation. Operator controls are located for finger-tip operation with either the right or left hand. A key switch provides positive turn off of power to the dual-control buttons, preventing accidental or unauthorized use of the truck. Other claimed features include smooth hydraulic lift, rapid raising of heavy loads, powerful electric drive, and good maneuverability.

Motors: Fairbanks, Morse & Co., 600 South Michigan Ave., Chicago 5—Company's line of totally enclosed, nonventilated, squirrel cage, induction motors has been extended to include continuous duty ratings. At present, 7½-hp, 1800-rpm and 5-hp, 1200-rpm motors are in production. These motors conform in all respects to NEMA and ASA standards for totally enclosed machines, and are identical in mounting dimensions with standard totally enclosed, fan-cooled motors of the same ratings.

Lenses: American Optical Co., Southbridge, Mass.—Bi-colored fused lenses are designed to protect the eyes of workers engaged in heat treating and furnace operations, scarfing and burning operations, some open hearth and blast furnace op-

erations, kiln processes, and welding. The new one-piece lenses can be replaced quickly in goggle frames. Because the lenses are fused into a solid piece, uniform thickness is said to be assured. Lenses are beveled to fit spectacle goggles or cup-type goggles and are made in regular and 6-curve, round and FV3 shapes. The following glass combinations are available: Cobalt-Clear; Noviweld-Clear; Calobar-Clear; and Noviweld-Calobar in half and half combinations.

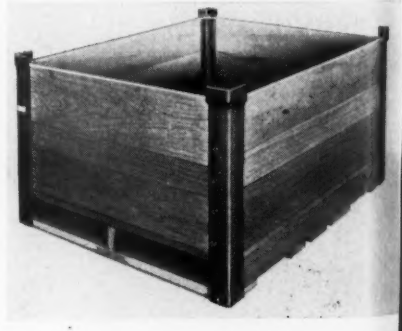
Electric Oven: Advance Heating Division, Jensen Specialties Inc., 9331 Freeland, Detroit 28—Industrial electric oven incorporates high efficiency rod-type heaters mounted on insulated oven wall sections. This is said to combine high-speed radiant heating with temperature controlled convection for industrial heating and drying operations up to 700° F. Ovens of any size, shape, and heat capacity can be field-assembled from standard parts by electrical maintenance personnel. The ovens can be enlarged or changed in the heating transfer rates by adding or removing standard catalog parts. From 4 to 40 kw of heat may be installed in each 26 x 84-in. panel. All vital parts



are maintained from outside the oven assembly. Illustration shows oven with one panel extended for servicing. Inset photo shows working side of this panel with rod-type electric heaters and reflectors.

Electric Drill: Newage International Inc., 235 East 42nd St., New York 17—Portable electric drill gun has ¼-in. drill capacity, weighs 2½-lb, and operates at 1600 rpm on alternating or direct current. Features claimed are an accurately balanced armature vacuum-impregnated, running on preloaded ball bearings which automatically maintain their adjustment, heat treated chrome molybdenum steel helical gears, and "deadman" quick make and break trigger switch with locking button.

Pallet Boxes: Ironbound Box & Lumber Co., 100 Hoffman Place, Hillside, N. J.—Hardwood pallet



boxes are available with two-way or four-way entry type pallet bottom. Spacing of bottom boards can be varied to accommodate standard fork truck or hand pallet trucks. Box is reinforced with outside and inside

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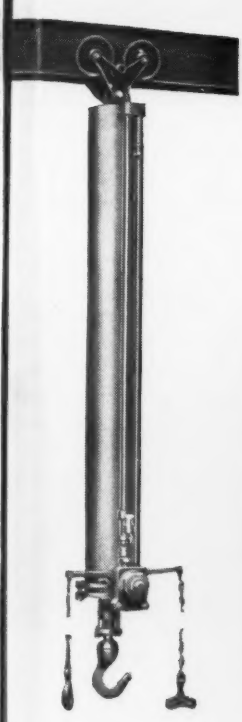

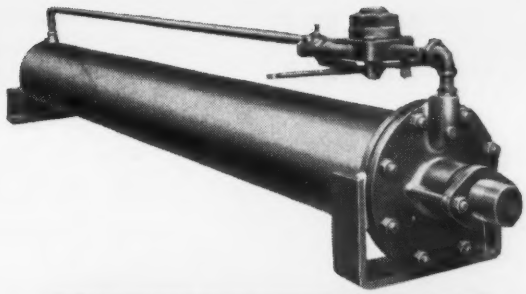

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STANDARD CONVEYORS

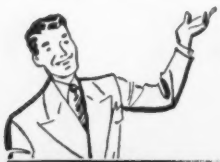
Cut Costs — Speed Operations — Give You

✓ **REDUCED HANDLING TIME**

✓ **UNINTERRUPTED SMOOTH FLOW IN PRODUCTION**

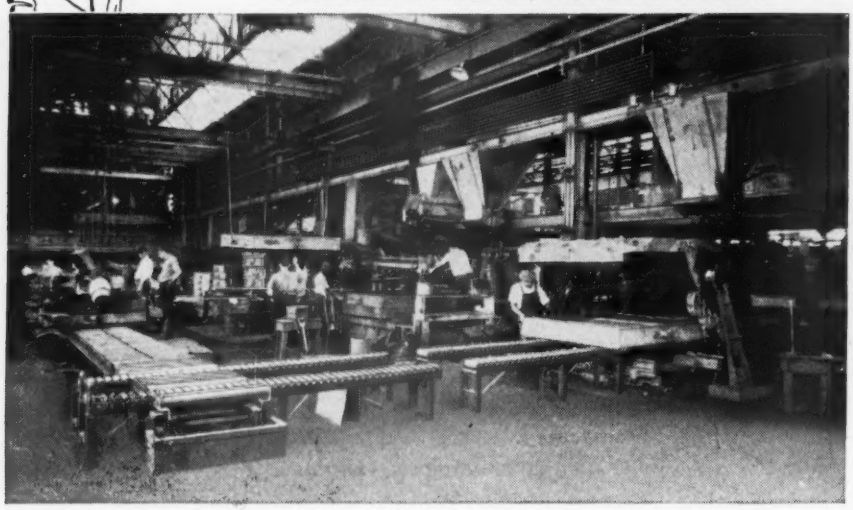
✓ **CAREFUL, SAFE HANDLING OF LIGHT OR HEAVY MOLDS**

✓ **BETTER STORAGE FACILITIES**



✓ **CONSERVE AND UTILIZE EXISTING FOUNDRY SPACE**

VISIT US AT BOOTHS 148-149
NATIONAL MATERIALS HANDLING EXPOSITION
INTERNATIONAL AMPHITHEATRE, CHICAGO—APRIL 30-MAY 4



STANDARD CONVEYOR COMPANY is able, through long experience to specify and build for every foundry handling need

Standard designs and builds conveyors expressly for foundry service — equipped with shielded and sealed bearings, protected against heat, dirt, sand, chips and grit for long-time, trouble-free operation.

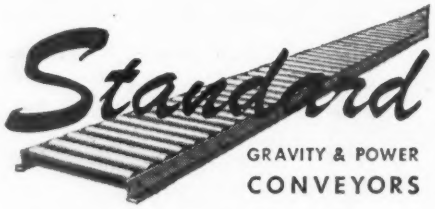
Available in a wide range of sizes, weights and types — as complete systems — or individual portable sections.

Whatever your specific need, Standard is qualified by experience and facilities to recommend and furnish the right type of conveyor.

STANDARD CONVEYOR COMPANY
General Offices: North St. Paul 9, Minn.
Sales and Service in Principal Cities

Engineered Conveyor Systems — Portable Conveyor Units — Spiral Chutes — Pneumatic Tube Systems

Send for Standard's special catalog "Conveyors for Foundries" — a valuable reference book illustrating and describing conveyor installations in leading foundries.

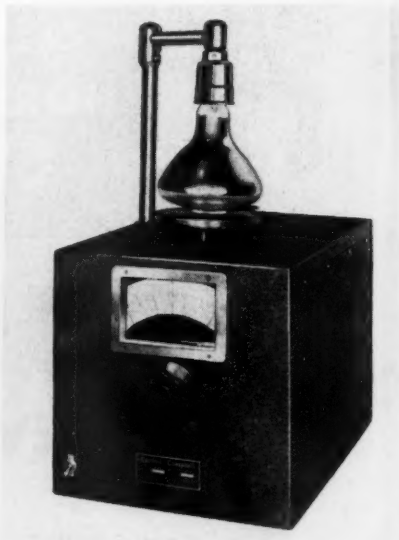


ENGINEERED FOR LOW-COST PRODUCTION

(*Continued from page* 252)

steel corner angles bolted throughout. Side boards are replaceable if they become damaged. Positive locking of tiered boxes is obtained by the design of the extended and flared corner angles at the top of the box. Units are available in any size to meet requirements.

Moisture Tester: Claud S. Cordon Co., 3000 South Wallace St., Chicago 16—Moisture tester is designed to determine moisture content of foundry sands and similar materials. Unit is simple to operate, and tests can be made at any location where an electrical connection



is available. The gravimetric principle employed in the instrument is said to give definite and reliable results. Use of the instrument involves placing a definite weight of material on a scale pan. The sample is dried with a heat bulb, and the moisture is indicated directly on a dial. Depending on moisture content of the sample, a complete test can be made in two to five minutes.

Remote Control: Sterling Electric Motors Inc., 5401 Anaheim-Telegraph Rd., Los Angeles 22—Mechanical remote control for the company's variable speed electric power drives is available in various types, such as with extended flexible cable, extended rod with universal joint, right angle bevel gear with extended rod, chain and sprocket, or a combination of any or all of these. A remotely located speed indicator with handwheel also is available with any of these mechanical remote control features. The control is designed to permit greater use of infinitely variable speeds and a steady flow of pow-

(*Continued on page* 256)

Easily Added to Cupola for Effective Deoxidation

FERROCARBO Briquettes by CARBORUNDUM are made from silicon carbide specially processed for metallurgical use—in a handy briquette size, for easy addition to the cupola charge. FERROCARBO Briquettes are readily soluble in molten iron, for thorough deoxidation... resulting in iron of prolonged fluidity, and cleaner, sharper castings.

FERROCARBO Briquettes

by CARBORUNDUM

TRADE MARK

Write or Phone our FERROCARBO Distributors:

KERCHNER, MARSHALL & CO., PITTSBURGH, Cleveland, Birmingham, Philadelphia and Buffalo
MILLER & COMPANY, CHICAGO, St. Louis and Cincinnati

● **FERROCARBO Briquettes** are manufactured under U. S. Patents 2,119,521 and 2,497,745. The process of making cast iron through utilization of silicon carbide is registered under U. S. Patent 2,020,171.

Made in Canada by the CANADIAN CARBORUNDUM COMPANY, LTD., Niagara Falls, Ontario
and Distributed in Canada by WILLIAMS & WILSON, TORONTO, Montreal and Windsor, *and by* KERCHNER, MARSHALL & CO., BUFFALO, N. Y.

"Carborundum" and "Ferrocarbo" are registered trademarks which indicate manufacture by The Carborundum Company, Niagara Falls, N. Y.

CLEAN UP
the
WASTE
Time and Cost
of
SCREENING
Moulding and Core Sands,
Coarse, Medium Fine, Dry or
Sticky Materials
COMBS GYRATORY RIDDLES
Are 10 to 20 Times Faster!

Now you can do a better screening job—sift, mix, fluff and aerate in one operation, in a fraction of the time and for a fraction of the cost of hand screening.

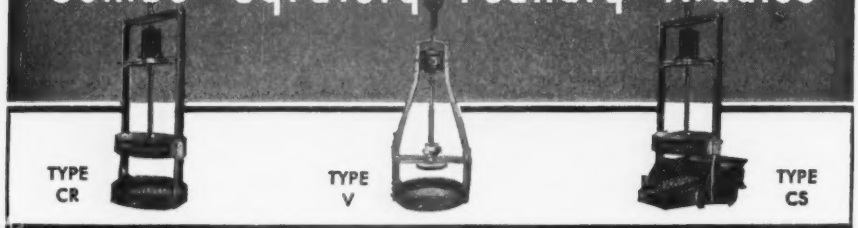
You can do from 10 to 20 men's work in a day with a low-cost Combs Gyratory Riddle—such as Type CS at left, which automatically discharges refuse, gaggers, etc. Completely equipped with a fractional horsepower motor (costs less than 1c an hour to run), quickly removable 24" screens and completely enclosed bearings.

Sturdy, compact—saves sand, saves time, saves manpower. Only $320 f.o.b.

Type CR—24" round screen, without automatic discharge (screen removed, cleaned, replaced in 5 seconds) $310.

PROMPT DELIVERY FROM YOUR FOUNDRY SUPPLY HOUSE

Combs • Gyratory • Foundry • Riddles

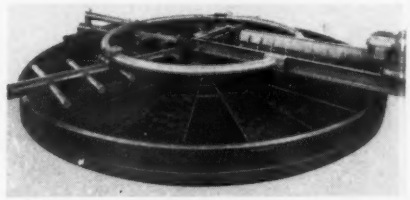


GREAT WESTERN MANUFACTURING CO.
LEAVENWORTH, KANSAS, U.S.A.

(*Continued from page* 254)

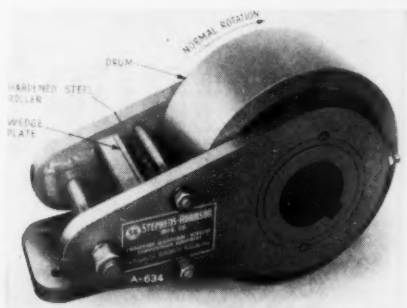
er at any selected speed, even under fluctuating load conditions. The electric power drives come in sizes from ½ to 25 hp and with 2:1, 3:1 or 4:1 speed variations in a range of speeds from 26 to 2000 rpm.

Rotary Filter: Oliver United Filters Inc., 2900 Glascock St., Oakland, Calif.—Horizontal rotary filter is said to be well suited to the washing and dewatering of foundry sand



contaminated with fine waste material, organic or inorganic. Capacity and removal of water are high. The cake usually is discharged with moisture content ranging from 6 to 8 per cent. Filter is available in sizes ranging from 10 to 165 sq ft of filter area and from 4 to 15 ft in diam. It is manufactured in steel, stainless steel, and lead protected.

Holdback: Stephens-Adamson Mfg. Co., 100 Ridgeway Ave., Aurora, Ill.—Roller type holdback is designed to prevent reversal of inclined conveyors and bucket elevators when power is interrupted. A hardened steel roller floats between a wedge plate and a drum keyed to the head shaft. When direction of rotation of the head shaft starts to reverse, due to power failure, the hardened steel



roller is wedged between the drum and plate, stopping motion gently and without shock, it is claimed. When power is reapplied, the holdback releases immediately.

Hand Cleaner: West Disinfecting Co., 42-16 West St., Long Island City 1, N. Y.—Powdered hand cleaner which contains a high percentage of "free" lanolin has been improved with the addition of lecith-

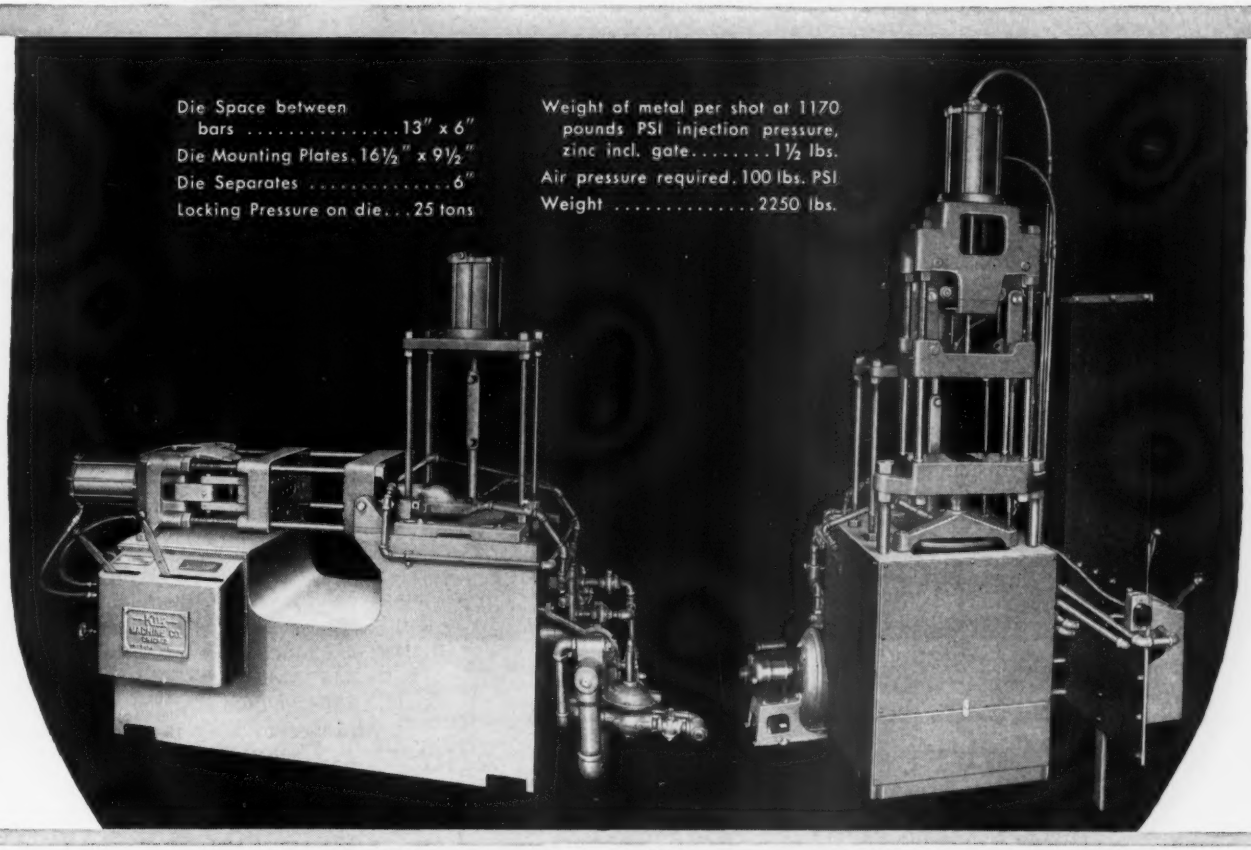
(*Continued on page* 258)

KUX

The Mighty MIDGET of Die Casting Machines

THE NEW KUX MODEL K

is the safest, most highly productive small die casting machine on the market! Available in horizontal or vertical center shot models, die castings weighing up to 1½ pounds in zinc are produced under high injection pressures, insuring quality, dense castings with minimum porosity. ***Compare these features:*** Center shot operation with floating nozzle always in seated contact with the die and one-piece gooseneck. Speed and power obtained by use of an air compressor to operate opening and closing of die, and metal injection plunger. Double safety lock, mechanical-electrical, prevents metal shot while die is in open position. Double toggle mechanism locking in two directions absorbs all locking pressures, operates on all four corners of die plate. Built-in ejector plate for positive ejection. Self-contained gas or oil firing unit.


Die Space between bars ..... 13" x 6"
Die Mounting Plates, 16½" x 9½"
Die Separates ..... 6"
Locking Pressure on die... 25 tons
Weight of metal per shot at 1170 pounds PSI injection pressure, zinc incl. gate..... 1½ lbs.
Air pressure required. 100 lbs. PSI
Weight ..... 2250 lbs.

Write now for an illustrated folder

KUX MACHINE COMPANY

3940 W. HARRISON STREET • CHICAGO 24, ILLINOIS

AN IMPORTANT SERVICE

We can now furnish, to pattern shops and foundries, pattern and core box castings without the necessity of lightening core boxes or backing off master patterns or core boxes. If you will send us your master pattern or core box or core stick, we shall be glad to quote you and supply complete information.

Photographs by courtesy of Erie Malleable Iron Company

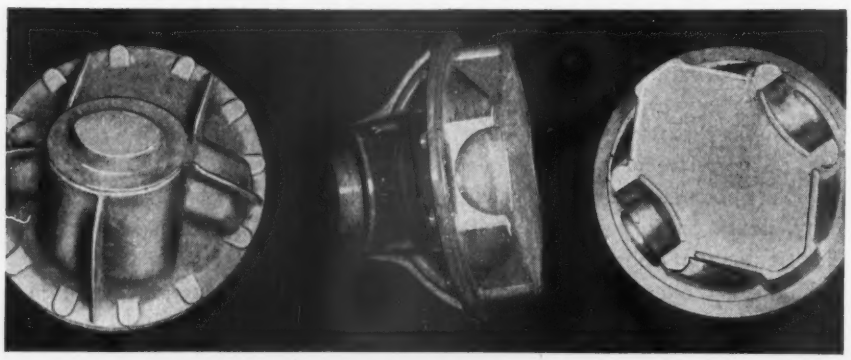
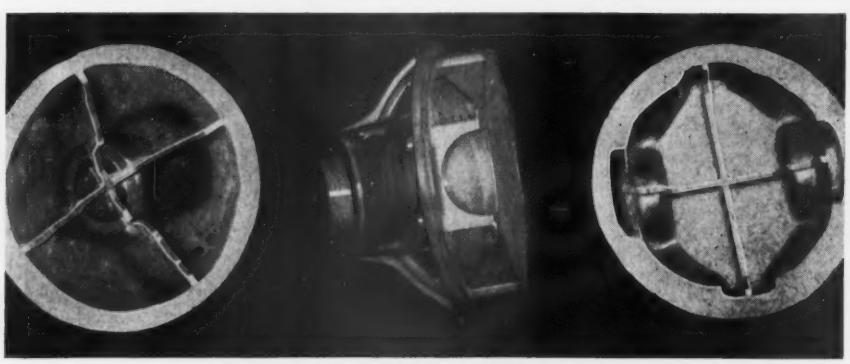
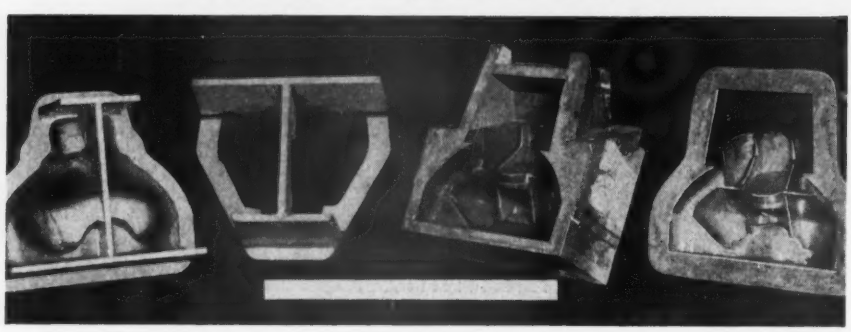


Photo shows face of pattern castings made from master pattern shown in center.



Pattern castings, showing method of lightening out.



Core box casting made from solid wood master core box, showing backing frame and method of backing off

PLASTER PROCESS CASTINGS COMPANY

6922 Carnegie Avenue **Cleveland 3, Ohio**

(Toledo Matchplate Co., Toledo 2, Ohio, Affiliated)

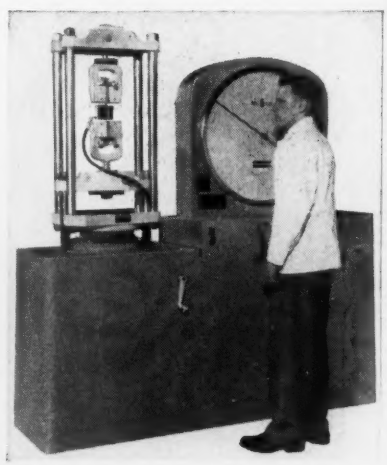
Pressure-Cast MATCHPLATES
COPE and DRAG PLATES

PROFIT BY OUR MANY YEARS OF EXPERIENCE

(Continued from page 256)

in, a soap intensifying emollient. Lecithin increases the soap's detergency and stabilizes a new foaming or sudsing effect. The cleaner is said to remove the most stubborn types of industrial soils. It contains no irritating caustics or gritty abrasives. Cleansing is accomplished by sponge-like action of fine grain cornmeal particles, which also act as the carrier for the emollients.

Testing Machines: Tinius Olsen Testing Machine Co., 1118 Easton Rd., Willow Grove, Pa.—Hydraulic testing machines for tension, compression, transverse and flexure testing feature a 50 to 1 spread of testing ranges on one 28-in. dial, the load being developed hydraulically and measured and indicated electron-



ically. All three test ranges—full, 1/5th, and 1/50th capacities—are indicated in three different colors on the same dial of the indicator; zeros for all ranges are identical. The 60,000-lb machine illustrated has additional ranges of 12,000 lb by 20-lb dial marks and 1200 lb by 2-lb divisions. Top range is indicated by 100-lb gradations. Testing speeds from 0 to 2 in. per minute are obtainable in stepless intervals by using a dual valve system which also applies, removes or holds loads constant. Other machines offer 120,000-lb, 200,000-lb, and 300,000-lb capacities with suitable middle ranges and with low ranges of 3000 lb, 4000 lb, and 6000 lb, respectively.

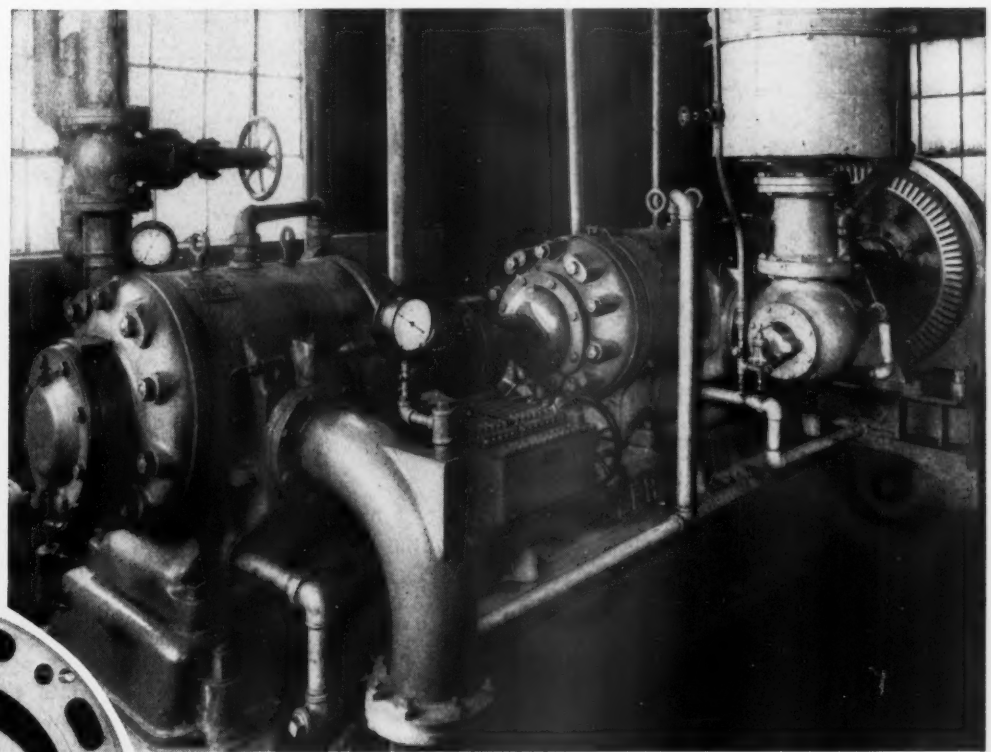
Motor Starter: Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30—New motor starter is designed to protect operating personnel as well as the connected machine. With ratings up to 600-v, 7½-hp polyphase, 5-hp single phase; or 220-v, 1½-hp dc, it starts, stops and provides overload protection for single phase, polyphase and direct current

(Continued on page 260)

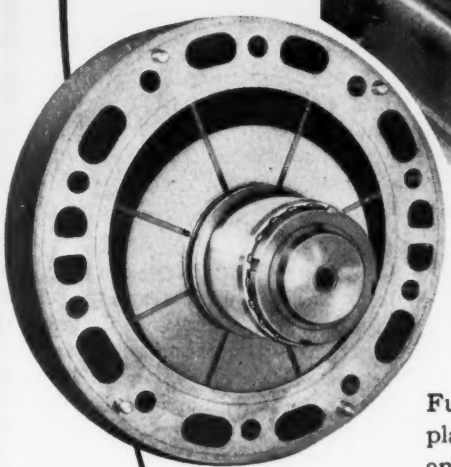
fuller

DRY MATERIAL CONVEYING SYSTEMS AND COOLERS
COMPRESSORS AND VACUUM PUMPS
FEEDERS, AND ASSOCIATED EQUIPMENT

sound lungs for industry



Forging Plant: Two-stage rotary compressor. Capacity 1665 c.f.m., 100-lb. pressure.



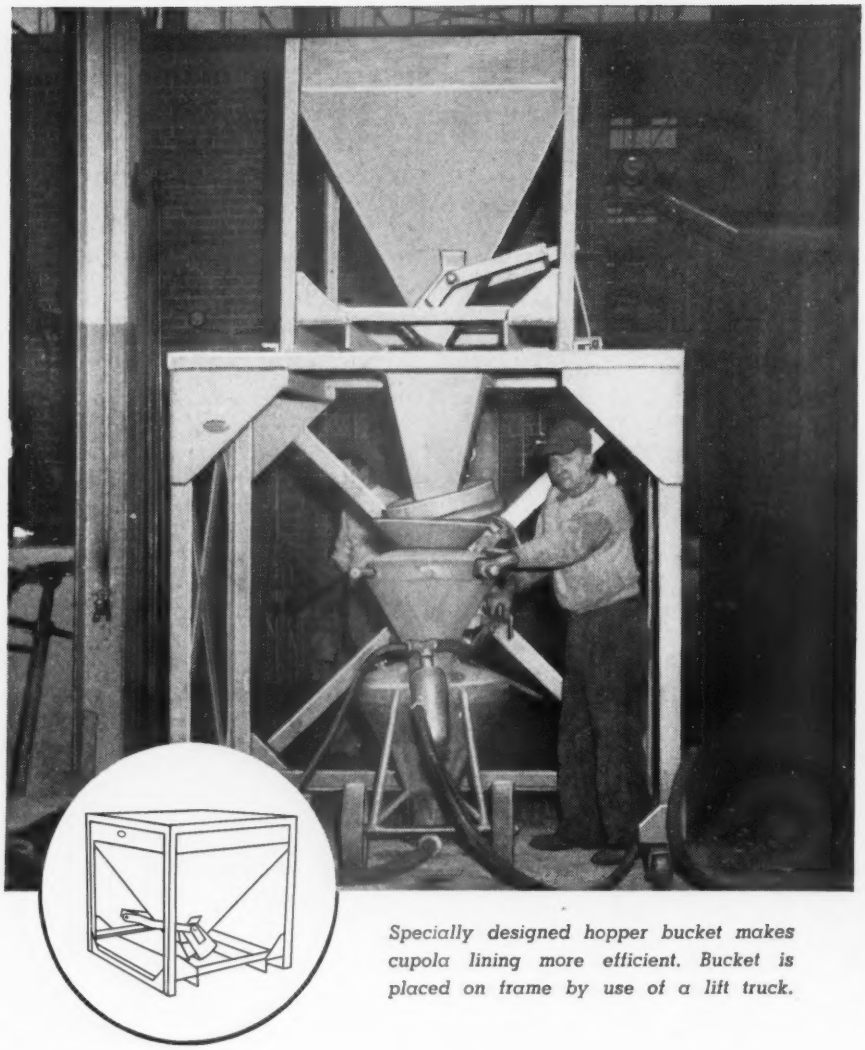
FULLER rotary compressors

Fuller Rotary Compressors are first choice for dependability in many plants the country over. That's only natural, because Fuller engineers and builds for trouble-free, long-term, low-cost operation. Fuller Rotary Compressors have but few moving parts . . . rotor, bearings, and blades. They need little attention, infrequent inspection. Maintenance is low . . . there are no valves to leak or seats to grind; blades automatically compensate for wear. *Full capacity is maintained for the life of the machine.*

It's this lifetime of new machine efficiency that makes them the logical, economical choice of many engineers and plant superintendents . . . means many repeat orders for Fuller Rotaries. They can't be beat as prime factors in reducing installation as well as operating costs.

A Fuller engineer will be glad to show you how Fuller Rotary Compressors can go on your payroll at the minimum wage. Get in touch with him today . . . or write for Bulletin C-5, which describes Fuller Rotaries in detail.

FULLER COMPANY, Catasauqua, Pa. · 120 So. LaSalle St., Chicago 3 · 420 Chancery Bldg., San Francisco 4 C-203



Specially designed hopper bucket makes cupola lining more efficient. Bucket is placed on frame by use of a lift truck.

Solve Your Material Handling Problems With PENN IRON SPECIAL EQUIPMENT

In lining cupolas, Textile Machine Works foundry in Reading, Pennsylvania, had difficulty handling the clay mix used with their Bondactor equipment. After a study of the problem, Penn Iron Works, Inc., designed, engineered and manufactured this special hopper bucket for maximum handling efficiency.

Whatever the bulk-material handling problem in your plant, Penn Iron Works, Inc., will be glad to help with its solution. Our wide experience in designing and manufacturing all types of buckets and special handling equipment for foundries can help you cut costs . . . save time . . . increase efficiency.

For Further Information Write:

FOUNDRY EQUIPMENT MEMBER FEMA MANUFACTURERS ASSOCIATION INC.

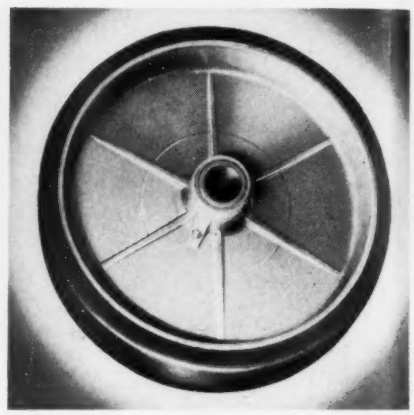
PENN IRON WORKS, INC.

READING, PENNSYLVANIA

(*Continued from page* 258)

motors. The self-indicating handle, interlocked cover that prevents opening unless starter is "off," and safety latch to lock starter "off" during servicing are personnel protection features. Motor protection is provided by the quick-make, quick-break, over center toggle mechanism (Deion arc quenching) and the bimetallic disk type thermal overload relay.

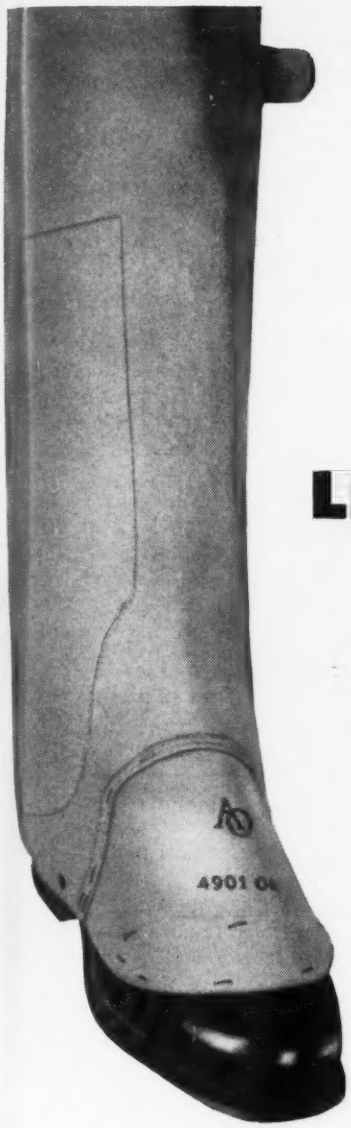
Wheels: Aerol Co., 2820 Ontario St., Burbank, Calif. — Sealed hub industrial wheels are made of cast aluminum with solid rubber tread. The hubs incorporate roller bearings and are said to exclude virtually all foreign matter responsible for excessive bearing and axle wear



and deterioration. A Zerk fitting permits periodic lubrication of bearings and axle without tie-up of handling equipment. Wheels are available in several diameters ranging from 6 to 20 in.

Safety Control: Drying Systems Inc., 1800 Foster Ave., Chicago 40—Safety control is designed to function as an automatic safeguard against fire and explosion hazards due to failure of burners, fans, fuel, or power on gas or oil-fired (gas piloted) ovens, furnaces and other heating equipment. It provides a single safety control station capable of supervising from one to sixteen burners with their incidental blowers and safety devices. Unit is said to shut off fuel to burners immediately if blower stops; power, gas pressure, or air pressure fails; fan belt breaks; component parts of the unit itself fail; any gas burner is extinguished, or any gas pilot light is extinguished on oil burning systems. It also is said to start fans by pull-push switch, automatically purge heated spaces and duct systems, spark ignite all pilot lights in the system, automatically energize main safety fuel valve circuit, constantly check electronic tubes before and during burner operation,

(*Concluded on page* 262)



4901CL LEGGING

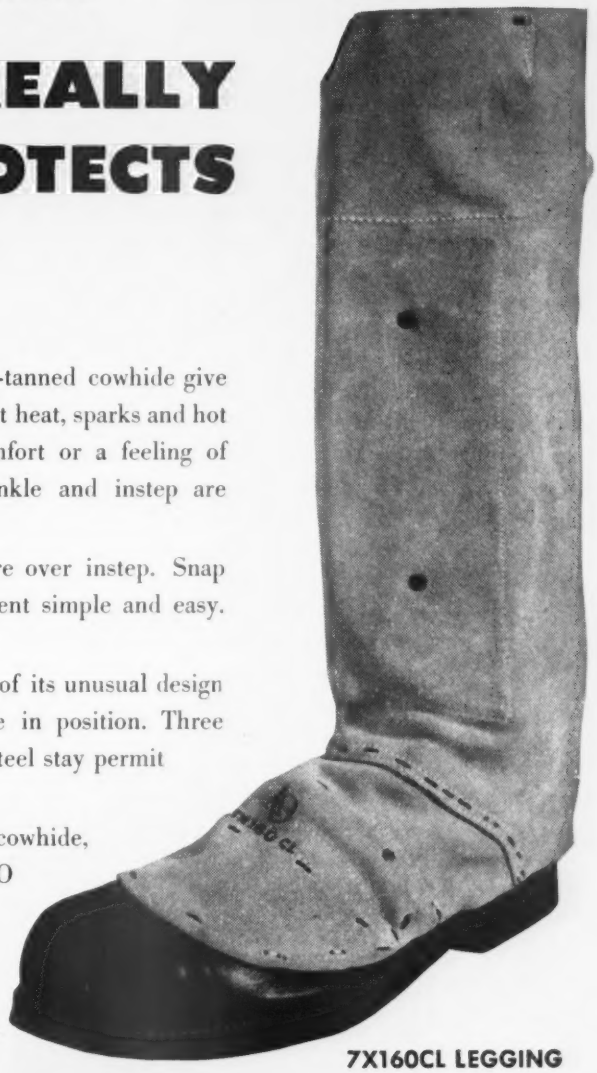
RUGGED LEG LEATHER for Foundrymen THAT REALLY PROTECTS

AO leggings of select chrome-tanned cowhide give *the* protection required against heat, sparks and hot metal splashes without discomfort or a feeling of bulkiness. The lower leg, ankle and instep are all unusually well protected.

The 4901CL Legging has a chrome leather flare over instep. Snap fasteners at top and under instep make adjustment simple and easy. Release is immediate in one swift motion.

The 7X160CL Legging is very popular because of its unusual design and features. Spring clip on instep holds flare in position. Three positions at top of legging and two at ankle for steel stay permit snug fit and immediate release.

Both leggings are available in chrome-tanned cowhide, asbestos or flame-resisting duck. Your nearest AO Safety Products Representative can supply you with either legging out of AO's complete line.

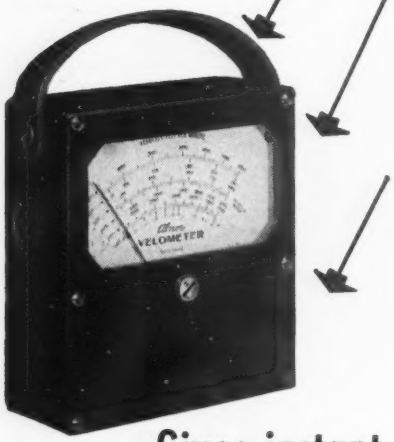


7X160CL LEGGING

American Optical
COMPANY
SAFETY PRODUCTS DIVISION

Southbridge, Massachusetts • Branches in Principal Cities

Alnor Velometer



Gives instant, direct reading of Air Velocity ...Anywhere!

Here is a precision-built, self-contained, portable instrument that gives instant, accurate reading of air velocities—anywhere. The Velometer is compact, portable—accurate in all ranges from high to low. Needs no calculations or reference charts. Anyone can use it and get accurate measurements. Available in a wide range of scales, and with a wide assortment of jets and fittings if needed. You'll want full details and prices, so write for Bulletin No. 2448-G. Illinois Testing Laboratories, Inc., Room 511, 420 N. La Salle Street, Chicago 10, Ill.

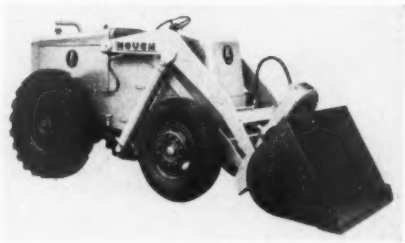
Alnor

PRECISION INSTRUMENTS FOR EVERY INDUSTRY

(*Concluded from page* 260)

and sound an alarm should heating equipment be shut off due to any of the above mentioned causes except power failure.

Tractor-Shovel: Frank G. Hough Co., 703 Sunnyside Ave., Libertyville, Ill.—Tractor-shovel has a 1¼-cu yd bucket and is available with 60-hp gasoline or diesel engine. En-



gine is at the rear over the drive wheels for maximum tractive effort and capacity, and the operator is located where he has a clear view in all directions. Features of the tractor-shovel include powerful bucket crowd and automatic bucket tipback that prevents spillage, hydraulic power control of bucket-dump and bucket-close, four speeds in each direction with maximum speed of 29 mph, and power-boosted steering. Digging angle or bucket pitch may be adjusted between 1 and 6 degrees. Maximum dumping clearance is over 8 ft.

Face Shields: Mine Safety Appliances Co., Braddock, Thomas, and Meade Sts., Pittsburgh 8—New line of face shields offers a choice of visors for specific types of hazards. One visor is designed to guard the face, eyes and neck against chemical splash, while the other offers particular protection against light, flying particles. Both visors are interchangeable on the company's standard headgear, which is preformed to fit natural contours of the head. The headgear is available in three types, with full spark guard, with semi spark guard, and with no spark guard.

Power Units: Ready Power Co., 11231 Freud Ave., Detroit 14—Diesel-electric power units for electric industrial truck operation are designed to power trucks of 6000-lb and larger capacity. The diesel models employ the same principle as the similar gasoline models—an engine-driven generator producing continuous electric power on the truck chassis. A new gasoline engine model is said to have advanced engineering features which speed maintenance and promote economy of operation. It is suitable for use with 4000-lb fork trucks, 10,000-lb platform trucks and 6000-lb crane trucks.

Magnetic Sweeper: Multi-finish Mfg. Co., Dept. 371, 2114 Monroe Ave., Detroit 7—Magnetic sweeper, widely used to clean up tramp iron, nails, screws, etc., from travelled areas, has found foundry application in salvaging steel shot and grit from floors. The tool is operated like a carpet sweeper and collects the shot on a permanent magnet tube which rotates between two Neoprene wheels. The tube is unloaded by a Neoprene wiper ring which pushes the collected shot to a nonmagnetic area at either end of the tube. The shot sweeper comes in five sizes, 11 to 36-in. wide. A heavy duty model is being developed for removing gates and other large scrap from sand.

Shop Truck: Klaas Machine & Mfg. Co., 4322 East 49th St., Cleveland 25—Shop truck can be used to haul waste, parts or other dry bulk material. Side dump feature of the truck is said to make disposal of the load easy, eliminating shoveling. The truck can be drawn by hand or powered vehicle, singly or in trains. It also may be used for temporary storage of materials. Counterbalanced hod is made of sheet metal, welded at the joints. Frame is of structural steel and wheels can be iron or rubber. The truck is 36 in. wide, 40 in. high, 6 ft long, and has capacity of approximately 1 cu yd.

Transfer Pump: Lincoln Engineering Co., 5702-31 Natural Bridge Ave., St. Louis 20—Air-operated transfer pump is designed to move fluids at the rate of 22 gpm. It can be used for transferring lubricants, thinners, coolants, naphthas, noncorrosive chemicals, and many other ma-

terials. Pump fits all 2-in. drum openings. It has a built-in, disk-type precision flow regulator to permit finger-tip regulation of output volume.

Steelmaking for Castings

(*Continued from page* 129)

therefore, all the phosphorus in the raw material is found in the finished steel. When the hearth is lined with magnesite or dolomite, which are chemically "basic," a slag containing a high proportion of lime (CaO) can be maintained. With such a slag, much of the phosphorus in the charge can be oxidized to phosphorus pentoxide (P_2O_5), held in solution by the slag and so removed from the steel. The basic process, therefore, is a purifying or refining one, while the acid method is not, and consequently requires purer and costlier pig iron and scrap as raw materials.

Fired With Producer Gas

For many years, most open-hearth furnaces were fired with producer gas. This fuel has so low a calorific value that only by preheating it in checker chambers a little smaller than those used for the air, but otherwise similar, can the furnace be raised to steel melting temperatures. In furnaces burning producer gas, therefore, there are two checker chambers at each end, and the passages leading from the checkers to the hearth are more complicated than those in a furnace in which natural gas or fuel oil are used. The latter fuels are injected through burners directly into the melting chamber. No burners are used for producer gas, which is brought into the furnace through openings or "ports" of considerable size in the brick work at the ends of the hearth.

Producer gas consists of a mixture of CO, H_2, various hydrocarbons, a certain amount of CO_2, and a great deal of inert nitrogen. Largely because it is diluted with so much nitrogen, its calorific value is not over 150 calories per cubic foot. Its composition varies somewhat as conditions in the producer change, and its combustion produces so large a volume of gases that the design of the furnace ends must be of a special type. To avoid undesirable changes in its composition, the gas should not be preheated too high, so that the efficiency of regeneration is not as great as is attainable with other fuels.

Especially in acid operation, the sulphur content in the coal fed to the producers must be kept to a minimum of 1 per cent; with higher sulphur coals, the steel absorbs too much sulphur from the SO_2 in the products of combustion. Even in basic practice, it is not desirable to use coal containing higher propor-

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tions of sulphur. In the small furnaces used in most steel foundries it takes longer to make a heat with producer gas than when firing fuel oil or natural gas. Producers require men to feed in the coal and clean out the ashes, whereas oil or natural gas are simply piped to the furnace. Under the best conditions, so much soot is deposited in producer gas mains that it has to be burned and scraped out once or twice a week, filling the air with a black cloud and making things generally uncomfortable about the shop. As a final demerit, producer gas, like Kipling's "Oont," "smells most awful vile," and no foundryman who ever worked with it, in the least regrets its disappearance.

In well designed large furnaces in some steel mills, producer gas is still burned with satisfactory results, but in American steel foundries it has been almost completely replaced by fuel oil and natural gas. These fuels have much higher calorific values, and furnaces using them are of simpler construction than those designed for producer gas. As only the air needs to be pre-heated, furnaces originally built for producer gas and later converted to burn natural gas or oil, pass the air through both checkers, while those designed for oil or natural gas have only one checker chamber at each end.

In integrated steel plants, the coke, gas and tar obtained by the distillation of bituminous coal in by-product coke ovens are the only fuels used in other departments. The open-hearth furnaces in these big mills, therefore, are fired frequently with tar and with mixtures of coke oven and blast furnace gases. These fuels, however, are not available in the average steel foundry. At one time powdered coal was tried as an open-hearth fuel, but it did not prove satisfactory. One of its chief disadvantages in open-hearth steelmaking is that the ash contaminates the slag, severely corrodes the roof and brickwork, and rapidly accumulates in the slag pockets and checkers. In at least one steel mill that tried powdered coal on a large scale a number of years ago, the steel made was too cold even for pouring ingots, and so much metal froze into heavy ladle "skulls" that the experiment was abandoned.

In American steel foundries, the choice between natural gas and fuel oil as open-hearth fuels depends upon their availability and price. Of the two, natural gas is more satisfactory, as it can be fed directly to the burners with no auxiliary equipment, has the very high calorific value of 960 to 1500 Btu per cu ft, and is almost completely free from sulphur. It, of course, does not have to be atomized as oil does, and produces what furnace men call a soft, rolling flame,

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A NEW type core oil developed by the Archer-Daniels-Midland Co., Cleveland, is claimed to permit extremely rapid baking, use of lower baking temperatures, and to resist overbaking at high temperatures.

Called Inductol, the oil is subjected to high pressure and temperature during manufacture. This causes partial polymerization, which results in rapid hardening at core baking temperatures above 350° F. The oil has a clear, amber color, a mild slightly sweet odor, and a viscosity similar to a light mineral oil. No special storage is required, and in the coreroom it is handled like any normal core oil —being added to the sand in the usual way, preferably as the last ingredient added to the mix. It is said that use of the oil leaves coreboxes clean, and produces a minimum of smoke and fumes during and after baking.

In comparison tests using the firm's standard core oil as the base, the new oil shows an increase of 40 per cent in green strength when cereal is used as the green strength agency. This indicates a possibility of reducing the amount of cereal used, especially where the concentration exceeds 2 per cent of the weight of the sand. Collapsibility of Inductol is reported to be excellent.

The accompanying table shows dry tensile strength of cores baked at different temperatures and for varying periods, One set of cores was made from a mixture containing 1 per cent Inductol, 1.5 per cent cereal, 3 per cent moisture and lake sand 40 AFS grain fineness. The other cores were from the same mixture, except for the substitution of the company's standard core oil for the new oil.

Temp, °F	Time, Min.	New Oil T.S., psi	Std. Oil T.S., psi
350	30	153	75
	60	242	114
	90	248	235
	120	252	271
400	30	220	72
	60	241	172
	90	234	291
	120	220	316
450	30	229	78
	60	212	250
	90	205	301
	120	201	305

which is easily adjusted to melt the charge with any desired amount of oxidizing effect. The Baume value of fuel oil used in open-hearth practice varies from 5 to 25 degrees at 60° F. The heavier oils must be heated to about 170 or 190° F by steam coils in the storage tanks and by steam pipes paralleling the supply lines to the furnaces, while oils of 22 to 24 degrees Baume need no preheating.

Enters at High Velocity

To feed the oil into the working chamber, atomizing types of burner are required, using either compressed air at from 60 to 120 psi or superheated steam at some 600 to 700° F as the atomizing agent. The spray of oil enters the furnace at high velocity, and carries an excess of oxygen with it, so that the flame is driven against the charge with something of a blow pipe effect, and is more oxidizing than a gas flame. With oil, therefore, the metal loses more carbon, manganese and silicon in melting, and the slag at meltdown will contain a higher proportion of iron oxide than when natural gas is burned. To minimize the absorption of sulphur from the SO_2 in the products of combustion, fuel oil for basic operation should contain not over 0.75 per cent sulphur, while in acid work a limit of 0.5 is required. Many fuel oils, therefore, are unsuitable for open hearth use.

Construction of a typical open-hearth furnace burning oil or natural gas is shown in Figs. 1 to 4. The hearth is built upon a structure of rolled or cast steel plates, supported by I-beams resting upon suitable piers. The front and back walls are set upon the same base, and are backed by plates and structural steel buckstays. The latter are held in place at the bottom by structural steel, but at the top are connected by tierods extending from front to back of the furnace. Below the hearth level at each end are brick chambers known as slag pockets, and vertical passages in the brickwork extend from the slag pockets to the open spaces at the ends of the furnace, beyond the hearth proper.

Behind the slag pocket chambers, and connected to them through large openings, are the regenerators or "checker chambers," filled with firebrick built up somewhat as a child makes a tower with wood blocks. Leading into the front of the chambers are the flues through which the combustion air is admitted and the products of combustion pass to the stack. Both slag pockets and checker chambers are held together

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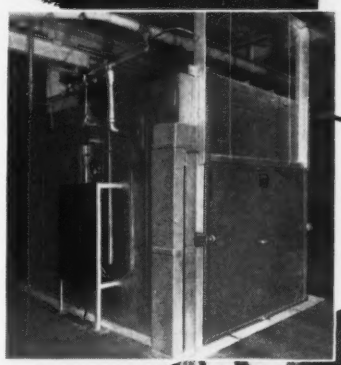

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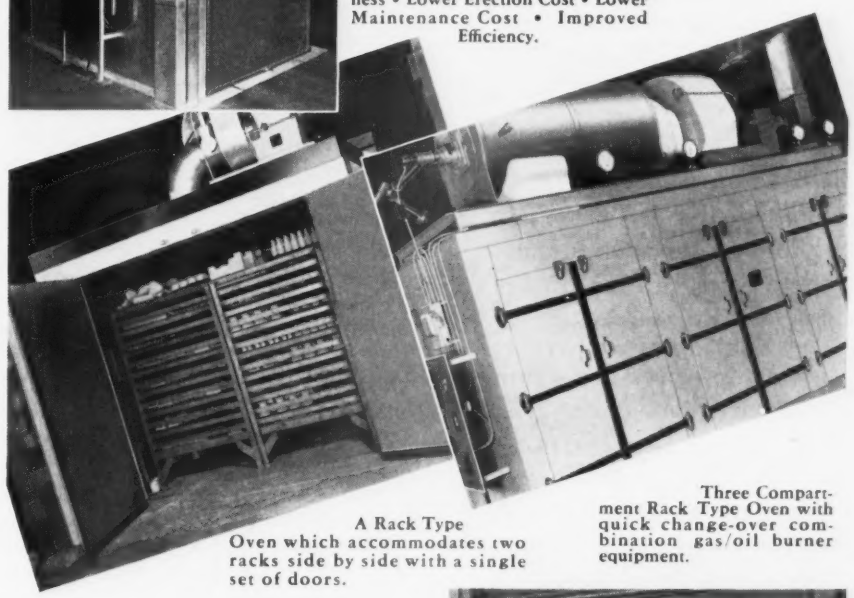

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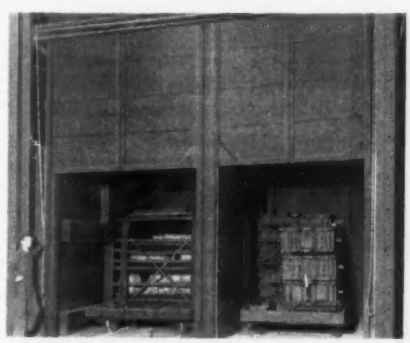

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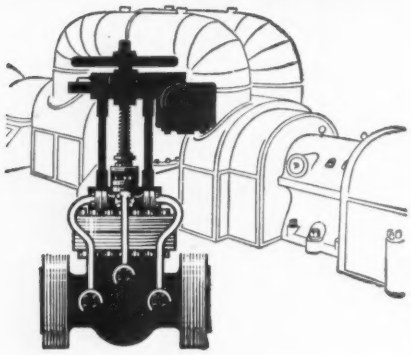

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Formerly the checker chambers were set directly under the ends of the furnace, and no slag pockets were provided. In a furnace built in this way, dust and particles of slag rapidly fill up the checkers instead of accumulating in the open slag pockets. The old design, therefore, has been abandoned in practically all American steel foundries.

The front and back walls of the furnace enclose the open spaces at the ends of the hearth, as well as the hearth itself, and brick walls pierced with openings to admit the burners close the ends of the structure. Over all is an arched brick roof, supported on skew-back brick that rest on steel channels held up by the buckstays. On the charging side of the furnace a number of water-cooled cast iron or steel door frames and water-cooled sliding doors, give access to the hearth, through arched openings in the front wall.

Furnace Charged by Machine

Metal to be melted is placed in the furnace by a machine running upon tracks on the working or charging side of the furnace. Pig iron, scrap, lime, etc. are brought to the floor in steel charging boxes set on small cars or buggies. The charging machine operator picks up these boxes on the end of a long steel arm, thrusts them through the charging door and rotates the box to dump its contents into the hearth. By moving the machine up and down its track, the boxes can be used to move heavy pieces in the furnace, and spread the charge evenly. Years ago furnaces were charged by hand, and by means of a "peel" suspended from the floor crane; the author worked on one of the last hand-charged furnaces to be operated.

Until quite recenty, the valves that reverse the direction of flow of the air and hot gases were of very simple construction, and the amount of air drawn through the furnace was regulated simply by varying the intake opening and by raising or lowering a gate damper in the flue leading to the stack. The latter was from 125 to 150 ft high, and naturally gave lots of draft, so that the damper seldom needed to be opened more than 6 in. or so. In many modern furnaces the air is forced into the checker chambers by fans and the reversing mechanism is much more complicated than the old-fashioned butterfly valves with which the author was familiar in the early days of the present century.

Though tall stacks are still used

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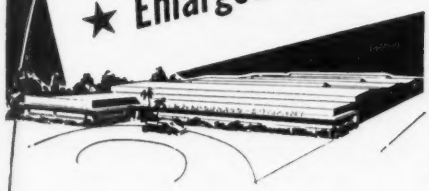

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on most furnaces, there is one design in which fans feed the combustion air to the checker chambers, and blow a stream of air up first one, then the other of a pair of short steel stacks of venturi form, to create the necessary draft. In some foundries, stacks of this type have now replaced the tall ones installed when the furnaces were built.

The old-fashioned open hearth operator ran his furnace by watching the flame and the roof through his blue glasses, at the same time keeping the tail of his eye on the smoke emitted by the stack. On the modern working floor, however, an almost bewildering array of indicating and recording instruments is provided for his guidance. Recording pyrometers keep a continuous record of the temperature of the checkers, and when the one through which the cool air is entering has reached a definite minimum, the furnace is reversed; in some installations reversal is automatic. When steam is used to atomize the oil, its pressure and temperature are measured and sometimes recorded; if the atomizing agent is compressed air, its pressure is shown on the gages. The volume of oil flowing to the burners is shown on recording instruments. When steam is used to keep the oil in tanks and pipe lines fluid, gages show its pressure and temperature. As the stack damper generally is located where it can not be seen from the working floor, a gage should be provided to show how wide it is opened.

Govern the Pressure

The pressure at the highest point within the furnace, generally about 0.05 to 0.10-in. of water, may also be measured and recorded. This pressure is governed normally by means of the damper in the stack flue, and is sometimes controlled automatically. By keeping track of the pressure, the operator is able to make the necessary adjustments of the damper opening.

Measurement of roof temperature is advocated by some operators, while others point out that a roof is not always at an even temperature all over, and it is dangerous to allow a first helper to get in the habit of depending entirely upon pyrometers instead of watching the roof for signs of incipient fusion. The instruments measure the temperature only at one, or at most a few points, and the men tend to grow careless and "touch" the roof at other places, while the pyrometers show that the temperature is within proper

(*Continued on page* 268)

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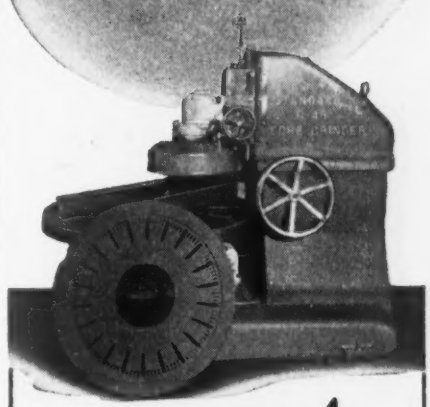

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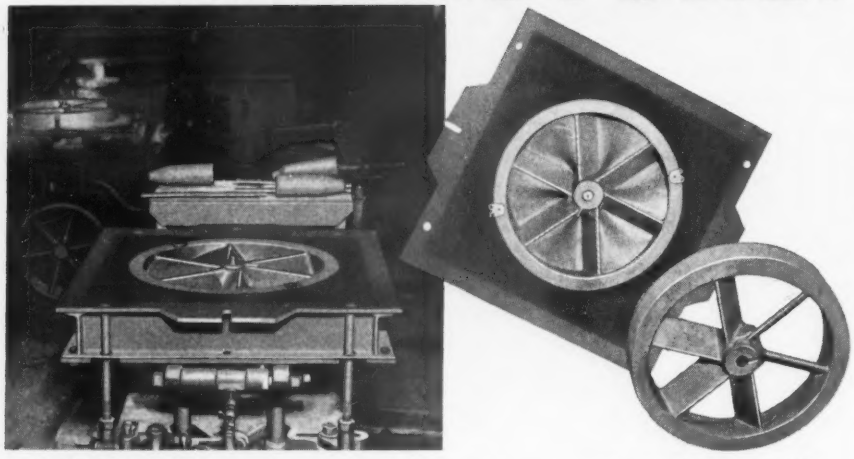

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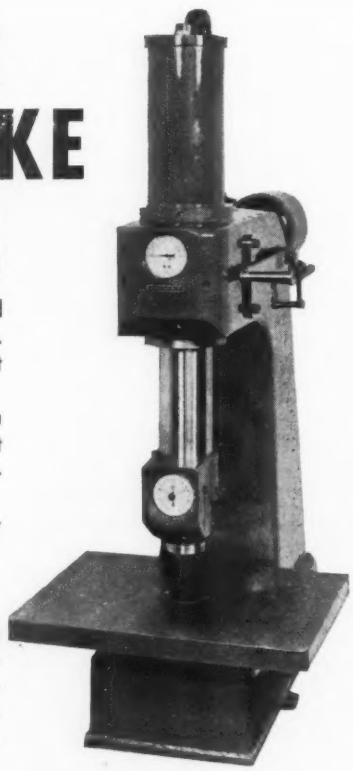

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(*Continued from page* 267)

limits.

A great deal of heat is lost by radiation through the brickwork, and in modern practice many parts of the furnace structure are insulated to decrease the amount of radiation. The flues leading to the stack, the walls and roofs of the regenerators, the slag pocket and up-take walls, and sometimes the side walls at the ends of the furnace, can be covered with suitable insulating material without danger that their inner faces will be heated beyond safe limits. A layer of insulation in the bottom, next to the pan, often composed of diatomaceous silica and portland cement, serves to reduce radiation through the bottom and lessens the expansion of the steel beams supporting the hearth.

May Become Too Hot

If the walls and roof of the working chamber are insulated, however, the inner faces of the brick may become entirely too hot. They will then melt away much faster than they otherwise would, and may even begin to actually drip and form long stalactites of fused silica. Even when no insulation is used on the roof, the operators have to be constantly on the alert to prevent it from being "touched" in this manner, and the chances of overheating a well insulated roof are much greater. Steel foundries require hotter steel than ingot shops and naturally operate open-hearth furnaces nearer the safe limiting temperature of the refractories. On the whole the feeling among them is that if the roof and side walls are insulated, the saving in heat losses is more than balanced by increased maintenance costs due to more rapid deterioration of the brick-work.

Refractory materials used for the brick-work and hearth linings of open hearth furnaces are shown in Table I.

Fireclay brick made of various refractory clays, after firing to dehydrate the kaolinite of which they are largely composed, contain some 45 per cent SiO_2 and 55 per cent Al_2O_3, and melt at approximately 3300° F. They soften, however, at somewhat lower temperatures. Special grades are now regularly produced, which contain higher proportions of Al_2O_3 and have higher softening and melting points.

In all parts of an open-hearth furnace that are exposed to the flame and the products of combustion, the brickwork is attacked by fine particles of iron oxide and slag swept up in the moving stream of gases.

and by a larger amount of vaporized iron oxide. The various compounds of FeO and SiO_2 formed by the attack of the vaporized iron oxide on fireclay brick have low melting points and are quite fluid. For this reason fireclay refractories are unsuitable for the interior portions of the furnace proper. They are used, however, for the walls and generally the arched roofs of the checker chambers, for the checker brick themselves and for the stack flues. The interior of heavy masses of brickwork that are not exposed to the full temperature of the furnaces are usually formed of clay brick, and one or two courses of them are almost always laid on the pan, to make up the lowest layers of the bottom.

The water-cooled doors of the furnace sometimes are lined with clay brick, or rammed-in mixtures of crushed firebrick and clay, sometimes with silica brick. Chrome ore aggregates held in place by welded studs have also been used to line doors. The life of door linings is quite short, but of course relining doors is far easier than patching the brick-work of the furnace itself.

Silica Bricks Are Strong

Raw material of which silica bricks are made is either quartzite or a silica-bonded sandstone. A very small amount of lime or other bond is mixed with the crushed material and the brick are fired at high temperatures. In firing, the quartz of the natural rock is largely altered to another form of silica called cristobalite. Both quartz and cristobalite have "inversion points" at which there is a sudden change of volume as the material is heated up. In quartz this point is at 1063° F; in cristobalite at 445° F. Because of this volume change, silica brick are likely to spall if heated so suddenly that one part changes volume while the rest of the brick does not. Fortunately, the volume changes occur below red heat, so that when once brought to working temperature, silica brick are stable and stronger than any other refractory.

Like clay brick, silica refractories are severely attacked by iron oxide, which forms compounds of FeO and SiO_2 of variable composition. They withstand the attack far better than do clay brick, however, because a very large amount of FeO must be absorbed by the silica before the brick actually fail. The gradual wearing away of the roof of an open-hearth furnace is due to this progressive attack by vaporized iron oxide.

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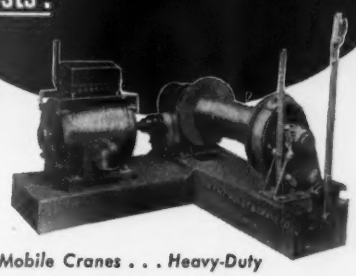

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magnesite or chrome ore brick, and have a high melting point, approximately 3142° F. Therefore, they are used for most parts of the furnace structure that are exposed to the flame and the hot products of combustion, including the slag pockets and the flues leading to the working chamber, the end, front and back walls, the brickwork under the bottom proper in acid furnaces, and the roof. At times the roofs of the checker chambers are also laid with silica brick. For some of the checker brick at the hottest end of the chamber, silica brick are occasionally substituted for clay brick.

For roofs, silica brick have a pronounced advantage over all other refractory materials, because above red heat they expand and contract to a very limited extent with further change of temperature. Once heated up, therefore, a silica brick roof does not bring heavy expansion stresses upon the skewbacks and supporting steel work. At the same time, the brick retains its strength at high temperature, and melts away quite slowly as it absorbs FeO from the furnace atmosphere. The glazing of the face of the brick by the absorbed FeO is helpful, because it makes the roof reflect more heat more than would rough brick.

Limit for Silica Brick

On the other hand, silica melts at 3142° F, so that some 3025 or 3050° F is about the limiting safe working temperature for the furnace roof and walls. As the steel must be brought to at least 2900 or 3000° F and is heated by a flame passing over its surface, which also contributes heat to the walls and roof, it is plain that in an open-hearth furnace, the range of safe working temperature is very narrow. It is largely for this reason that attempts to adapt the process to the manufacture of small castings have almost invariably failed. At the extreme temperatures required to run small castings, the brick work of the furnace gives way rapidly and the maintenance expense is correspondingly high.

It formerly was supposed that the roof of an open-hearth furnace should not be over 9 in. thick, so that heat loss by conduction and radiation would keep the inside of the roof from becoming too hot. Today, roofs in the larger steel foundry furnaces are laid of 12 or 15-in. brick, with several rings of thicker ones to reinforce them. To allow for the longitudinal expansion of the roof, small spaces at intervals of about 12 in. are left betwen the bricks as they are put in place. The transverse ex-

pansion is usually taken care of by gradually loosening the nuts on the tie rods as the roof heats up. Unless some other means are provided to allow the roof to expand, failure to loosen the nuts will result in their stripping off the rods and flying across the shop like bullets.

(To be continued next month)

Aluminum Die Castings

(*Continued from page* 127)

num alloys.

The maximum pressure that can be used from a practical standpoint in air-injection gooseneck machines placed definite limitation on the size and complexity of aluminum die castings that could be successfully produced. To obtain higher pressures, the cold-chamber machine was developed. In this machine, a charge of molten metal is ladled into the "cold chamber" and is then forced into the die by means of a hydraulically actuated steel plunger. The much higher pressures of which this machine is capable are maintained long ...igh during the operating cycle so ...hat the freezing alloy is compacted ...s long as it remains in the plastic ...state. By reducing gas porosity, the higher pressures produce castings of greater density and soundness.

The higher pressures make it possible to inject the metal more rapidly and completely into thin sections or remote parts of large and intricate ...tings before it chills. They also ...provide a means of successfully die casting alloys that are relatively sluggish in their molten state.

Machines Are Heavy

Because of the advantages of the cold-chamber machines and the general superiority of castings produced at the higher pressures, air-injection machines are gradually disappearing in favor of the higher-pressure machines, although air-injection machines probably will continue in use for many years for some types of work. Operating speeds up to 150 cycles per hour are possible with either type of equipment when casting small or medium-sized parts of simple design. Multicavity dies, which produce two or more castings per cycle, often provide a convenient means of boosting production rates.

Die-casting machines must be heavy enough to support the dies, which today weigh up to several tons, and to withstand the pressures used in injecting the metal into the die. A massive framework supports two platens, one stationary and the other

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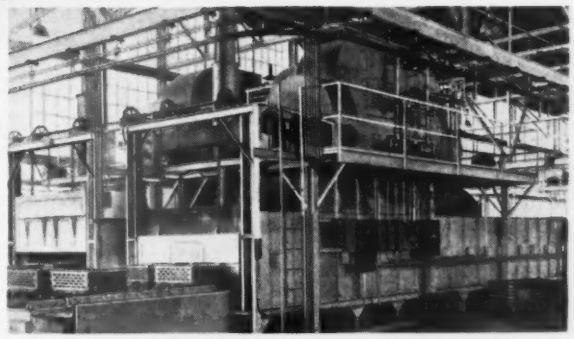

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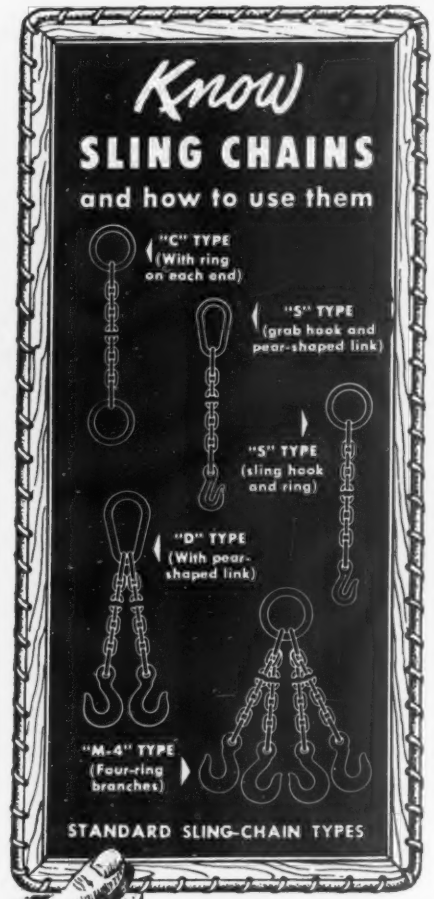
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movable, on which the two halves of the die are mounted. A suitable mechanism is provided to actuate the movable platen.

The machines must be sufficiently rigid to keep the two halves of the die in perfect alignment, and the locking mechanism must be strong enough to keep the two parts of the die securely locked together when the "shot" is made. Some machines use a toggle mechanism to lock the die halves together; others use either a pneumatic or hydraulic ram. The higher-pressure machines are hydraulically operated, as locking pressures up to 1000 tons sometimes are required. Both vertical and horizontal mounting is used for the metal injection system, but the horizontal arrangement is more common in modern equipment.

The dies themselves must be strong and rugged enough to withstand the required pressures. They must also withstand in continuous operation the relatively high temperatures involved in die casting aluminum alloys. To meet these requirements, the dies are made from special alloy steels completely heat treated before use.

The successful die casting of aluminum alloys requires careful control of die temperature. This is accomplished by water-cooling. Passages are drilled into the die block through which the cooling water is circulated. By varying the flow of water through these channels, the temperature of the die may be regulated to its optimum operating value.

Aluminum Die-Casting Alloys—All aluminum alloys that can be cast by either the sand or permanent-mold

NFA HOLDS REGIONAL MEETING

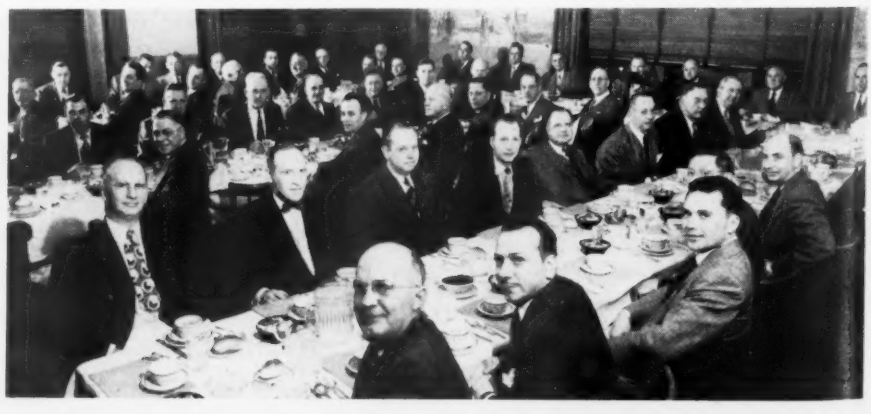
MANPOWER, wages, raw materials, security, priorities and allocations were topics for the Chicago area foundry conference the National Foundry Association sponsored at the Lake Shore Club, Jan. 30. About 60 foundrymen attended. NFA President A. V. Martens, manager, Pekin Foundry & Mfg. Co., Pekin, Ill., presided and in his remarks set the stage for later discussions. In particular, he reported on the pig iron situation. L. E. Roark, executive vice president, Chicago, spoke at some length on problems the defense program is presenting to foundrymen and suggested steps to overcome them.

Mr. Roark urged the membership to take advantage of the services and guidance to be obtained from consultation with Fred A. Hartley, former congressman, who is in charge of the NFA Washington office.

A panel headed by C. S. Haagensen, industrial relations division, Allis-Chalmers Mfg. Co., Milwaukee, directed the discussion on "Manpower-Wage Contract." Other members of the panel were: Fred B. Skeates, personnel director, Link-Belt Co., Chicago; Eric Schwantes, training director, McCormick Works, International Harvester Co., Chicago; and Roger Hubbell, wage administration division, Allis-Chalmers Mfg. Co., Milwaukee.

Among the questions raised and discussed were: "How to induce young high school boys to enter the foundry?," "What effect will escalator clauses have on wage stabilization?," "What is the experience with displaced persons in the foundry?," "How close is the foundry to use of foreign labor?," "What should management do now to get ready for wage stabilization?," and "Can DO orders be extended on coke as they are for pig iron."

Advice cited on the latter question was that DO ratings can not be extended on coke. Explanation is that coke, being a solid fuel, is under administration of the Interior Department whereas pig iron is under control of the Commerce Department. The former department has not agreed to control by NPA.



methods may also be die cast. By using special equipment, even pure aluminum may be die cast where high electrical conductivity is required. Practically all die castings produced today, however, are made from alloys specially developed for the die-casting process. Specifications issued by the American Society for Testing Materials list ten aluminum alloys for die casting use. The nominal composition and mechanical characteristics of these alloys are listed in the accompanying tables.

Aluminum die-casting alloys in common use today may be classified into three general groups: Those containing silicon as the principal alloying element; those containing silicon and copper; and those in which magnesium is the principal metal added.

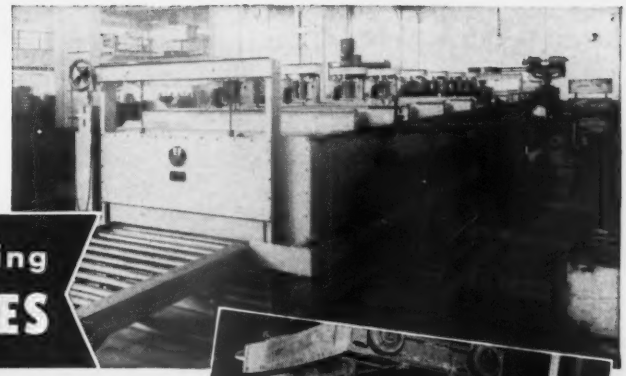
The aluminum-silicon alloys S4, S5 and S9 have the best casting characteristics and therefore are generally used for large, intricate, thin-walled castings. They have excellent resistance to corrosion, especially in salt water atmospheres. They are somewhat more difficult to machine than other die-casting alloys.

Better Mechanical Properties

Some of the aluminum-silicon alloys are subject to abrupt solidification when approaching the setting point. To overcome this drawback alloys SG2 and SG3 were developed, which are aluminum-silicon alloys containing 0.5 per cent magnesium. These alloys also have better mechanical properties than the straight aluminum-silicon alloys of the same silicon content and castability.

Where minimum cost is essential, one of the aluminum-silicon-copper alloys (SC2, SC5, SC6, or SC7) may be used. These are produced mostly from scrap or secondary metal, especially airplane scrap which usually contains copper. Normally, secondary ingot is available at low cost, although today it costs more than primary alloy ingot because of the shortage of primary metal. The aluminum-silicon-copper alloys have good casting characteristics and are somewhat easier to machine than the aluminum-silicon alloys.

Alloy G2, containing 8 per cent magnesium, has the best combination of strength and ductility of any of the aluminum die-casting alloys. It has excellent resistance to corrosion and may be given a high polish. Its surface characteristics are especially good where chemical or anodic finishes are to be applied. Its machining characteristics are also the best of all the aluminum die-casting al-



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loys. This alloy, however, is more difficult to cast than the other die-casting alloys and more careful handling is required to reach its optimum mechanical properties in the finished castings.

Alloys S9, SC5, SC6 and SG2, for which low iron content is specified, may be cast only in cold-chamber machines. High purity is not necessary in aluminum die-casting alloys; therefore the specifications permit wider variations in alloying elements classed as impurities than do those for other die casting metals or for most of the aluminum alloys used with other casting processes. Iron, however, affects the mechanical properties adversely if present in too high a percentage, and therefore it is desirable to keep the iron content within close limits.

Aluminum in molten form will pick up iron from the iron and steel equipment with which it comes into contact, and this pickup is greater at the higher temperatures. Because there is less contact between the molten aluminum and iron and steel parts in cold-chamber machines, and since the metal can be cast at lower temperatures in these machines, the iron content can be held to smaller percentages than in gooseneck machines.

In selecting an alloy for a given casting, the user should rely heavily on the recommendation of the die caster. From his experience he is in perhaps the best position to determine which alloy will give the best results for a part of given size and shape to be produced in the type of machines he is using. Intricate parts require the more fluid alloys of the aluminum-silicon type. Other factors to be borne in mind are resistance to corrosion, machining characteristics, and adaptability to a desired surface finish. In all cases, that alloy should be used which will give the best overall result at the lowest cost.

(To be concluded next month)

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SOURCES OF ILLUSTRATIONS

Figs. 1, 6, 7, 8—Aluminum Co. of America.
Figs. 2, 3—From *Designing for Alcoa Die Castings.*
Fig. 4—Federated Metals Division, American Smelting & Refining Co.
Fig. 5—Bell & Howell Co.

HYDRAULIC LIFT: Newest attachment developed for the power wheelbarrow manufactured by Kwik-Mix Co., Port Washington, Wis., is a hand operated hydraulic fork lift. It is shown here in operation at the Badger Brass & Aluminum Foundry Co., Milwaukee

Choke Control in Gating

(*Continued from page* 117)

most of the feeding (Fig. 4A) and swirling turbulence was predominant. This was true also but to a less pronounced extent with the second system (F=0.5-in. diam, SA—FA=1—1), Fig. 4B. The third system (F=0.375-in. diam, SA—FA=1—½) produced uniform feeding (Fig. 4C) throughout pouring.

The effect of increasing the finger length from the usual 3 in. to 6 in. was also studied. Increasing the distance in the system in which SA—FA=1—2 (Fig. 4D) did not alter appreciably the uneven flow produced by the system with 3-in. fingers. This same increase in length for a system having SA—FA=1—1 did, however, definitely improve uniformity of flow; in the late stages flow was completely uniform. Flow from this system is shown in Fig. 4E (compare with 4B).

In systems having SA—FA ratios of 1—1, uniform feeding is obtained when the fingers are straight but not when flared, as can be seen by comparing Figs. 3B and 4B. Both of these systems are geometrically choked, but only the straight fingers provide definite hydraulic choking. It is thus indicated that the milder choking effect of flared fingers may be compensated by increasing the length of such fingers relative to the length of the straight fingers. The added friction resulting from increasing the length of the fingers may be considered "frictional" choke.

Tapered Fingers—The gating systems shown in Fig. 5 had tapered fingers. These fingers may be considered as similar to the flared fingers studied previously being reversed, however, so that the smallest cross section of the fingers is at the mold cavity, and the enlarged portion at the runner. In the first system (F=0.75-in. diam, SA—FA=1—2) the outer fingers fed the most (Fig. 5A) and swirling turbulence occurred throughout pouring. In the second system (F=0.5-in. diam, SA—FA=1—1), the outer fingers again fed the most (Fig. 5B) but uniform feeding occurred near the end of pouring. With the third system (F=0.375-in. diam, SA—FA=1—½) all fingers fed uniformly, but with a pronounced jet effect (Fig. 5C).

Increasing the distance between runner and casting to 6 in. in the system in which SA—FA=1—2 caused no significant improvement in uniformity of flow (Fig. 5D). Increasing the distance in a system having SA—FA=1—1 (Fig. 5E) improved flow uniformity as shown by

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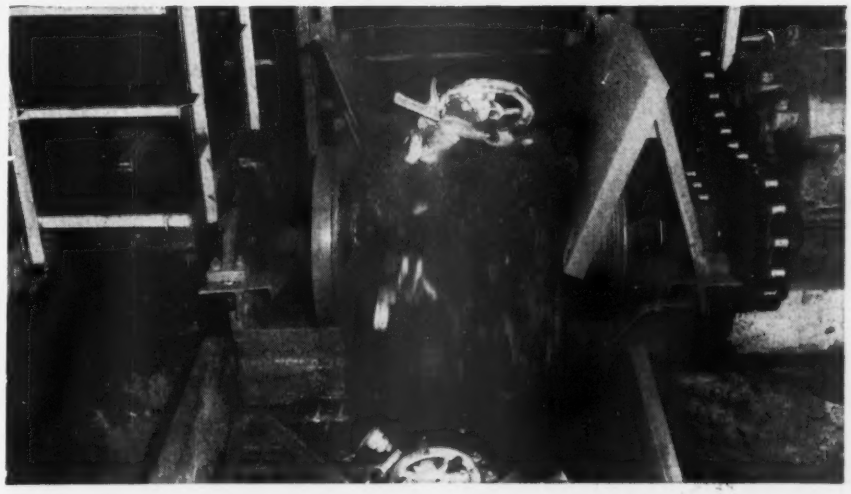

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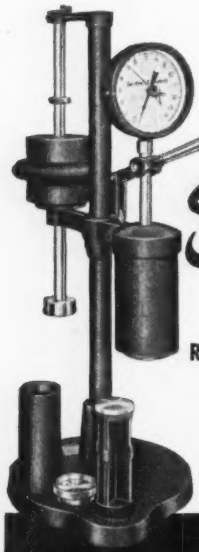

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the changeover from nonuniform to uniform flow at an earlier stage in the pouring. The tendency toward more uniform flow is indicated by comparison of Figs. 5B and 5E.

Reversing the direction of flare of the fingers is of only slight benefit in improving flow uniformity, as may be deduced by comparison of 4B and 5B (SA—FA=1—1 systems). The smaller opening at the casting of the tapered fingers, however, tends to create a detrimental jet effect, as indicated by comparison of the SA—FA=1—½ systems (Fig. 4C vs. 5C).

Streamlined Fingers—This group of gating systems (Fig. 6) had fingers designed to approach streamlined entry of the metal into the mold. The smallest portion of the fingers was midway between the runner and casting.

In the first two systems (F=0.75-in. diam and 0.5-in. diam; SA—FA=1—2 and 1—1, respectively) a greater quantity of metal entered through the outer fingers (Figs. 6A and 6B) and swirling occurred throughout pouring. When the smallest portion of the finger was reduced to F=0.375-in. diam (SA—FA=1—½), Fig. 6C, all fingers fed uniformly but with jet effect.

Increasing the distance between runner and casting to 6 in. in a streamlined finger system (Figs. 6D and 6E) was again somewhat beneficial in the system having SA—FA=1—1, in that it caused flow to become uniform when the mold was only approximately half filled. As was the case with flared and tapered fingers, streamlined fingers offer less flow resistance than straight fingers; hence a more pronounced condition of geometric choking is necessary to cause hydraulic choking.

Rectangular Fingers—The rectangular shaped fingers (Fig. 7), were always 1 in. wide but varied in thickness to give the desired SA—FA ratios.

The first system (F=1×½, SA—FA=1—2) produced uneven flow at first (Fig. 7A) which later became uniform. All of the fingers fed uniformly in the last two systems (F=1×¼-in. and 1×⅛-in.; SA—FA=1—1 and 1—½, respectively) of Figs. 7B and 7C, but there was a strong jet effect in the latter system which caused an irregular turbulence.

CHEESE is made from equipment utilizing this part manufactured by Wisconsin Centrifugal Foundry Inc., Waukesha, Wis. Melvin G. Morris is shown measuring the casting which is 36 in. in diam and weighs 1600 lb. The fast-growing firm, organized five years ago, is completing a $50,000 expansion program and now employs 28 men and occupies about 11,000 sq ft of floor space. Last spring the firm bought the Keystone Corp., Milwaukee, acquiring its equipment

Since systems with rectangular fingers produced partial (late stage) flow uniformity even for geometrically free systems of SA—FA ratios of 1—2, it appears that the maximum finger area which can be tolerated without resulting in nonuniform flow is larger than in the systems with straight, "circular" fingers. Rectangular fingers develop greater hydraulic choking than would be predicted from geometric considerations because of their high surface area to volume relationship, which is a measure of frictional resistance to flow.

Summary and Conclusions—Uniform feeding by choke control depends on the development of general pressure in the gating system. Such a condition results in forced flow from all openings into the casting cavity regardless of position or number. To develop such a general pressure condition it is essential that choking be established at the fingers. A choked condition established between runner and sprue serves no purpose except to slow down metal flow. Moreover, pressurization is not extended to the fingers. Accordingly it is best to provide a geometrically free condition in the transition point between sprue and runner.

The geometrical choked condition of the system, described as the ratio of the sprue area to the finger area, provides a rough index of the relative liquid transport capacity of the sprue versus the fingers. If the fingers can carry more liquid than the sprue can supply, free flow directed by momentum effects will be developed; such flow is generally nonuniform. On the other hand, if the fingers cannot carry all of the liquid which the sprue can supply the system becomes pressurized throughout with resulting uniform flow.

Only a slight general pressure is necessary to produce essentially uniform feeding. Such feeding is obtained in parallel-walled fingers when the sprue area and the total finger areas are equal. Too great a general pressure condition, while resulting in completely uniform feeding, is undesirable because it is accompanied by a jet effect which may damage the mold, and also produce an exaggerated turbulence detrimental from a dross formation and gas absorption standpoint. A detailed report of these effects has been issued.[4]

Shape factors can cause the relationship between the geometric and actual choke (hydraulic) conditions to vary. The variations in the critical sprue-finger area relationships for hydraulic choking are the result of differences in flow resistance in

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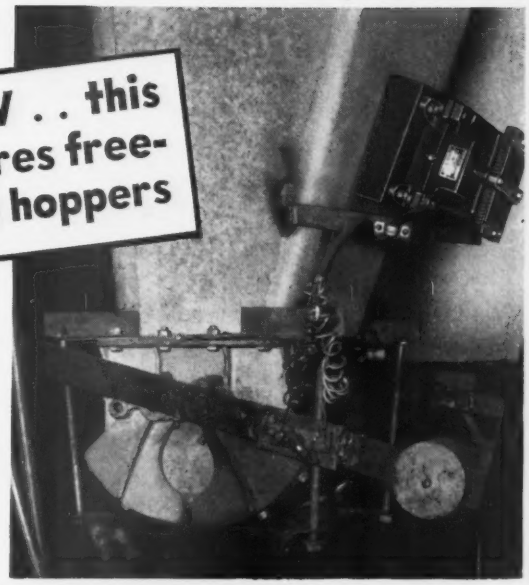

The V-55 Electric Vibrator on this sand hopper above moulding station in foundry is linked to gate for automatic operation . . . starts when gate is opened . . . stops when gate is closed.

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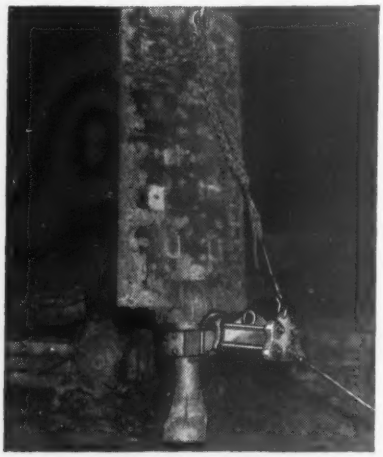

Here's a 5" "BRANFORD" RAPPER removing sand core from a 3½ ton gate casting for a hydro-electric plant. Rapper is attached to sprue by a cast bracket specially designed by user to take head of the "BRANFORD" rapper.

The same casting completely cleaned in two hours with one man in attendance. This job formerly took two men one full day.

Send us sketch of casting, specifications, and composition of core and we will quote on proper equipment.

Photos courtesy Penn. Elec. Steel Casting Co.

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the fingers. This flow resistance, which is equivalent to added choke, may be termed frictional choke. Streamlined, flared and tapered fingers offer relatively little obstruction to flow. Consequently, very little added frictional choke is provided by such fingers, and systems using such fingers require somewhat greater geometric choking relationship between finger and sprue than would be required for straight-sided fingers. Lengthening the fingers is another means of adding frictional choke.

The functioning characteristics of flared fingers deserves separate mention inasmuch as such fingers are used in practice with the aim of fanning the metal streams. It was shown that the desired functioning of such fingers is difficult to realize in choked multiple finger systems. Pressurization required for simultaneous flow from all fingers produces sufficient velocity of stream to prevent fanning to the full extent of the flare design. In single-finger systems pressurization is not a problem, hence low exit velocities requisite for fanning may be obtained with flare designs.

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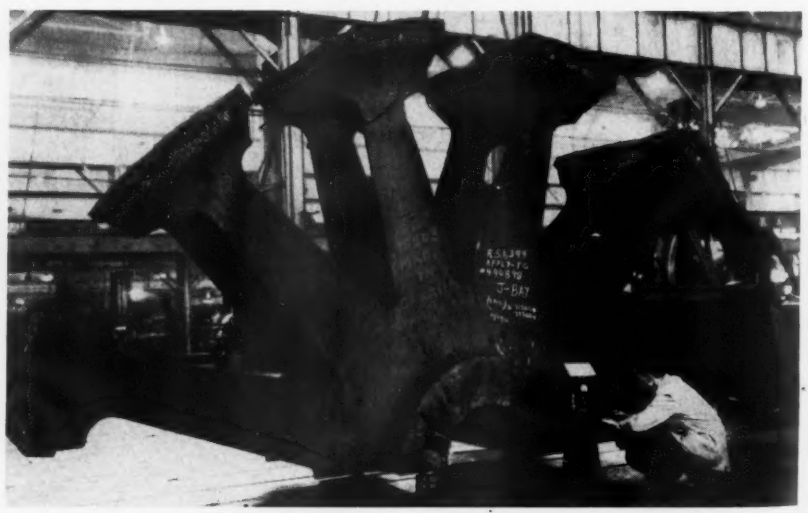
Nickel-Tin Bronze Theory

(*Continued from page* 133)

added comment that castings containing lead may suffer disaster by hot cracking during the quenching from the 1400°F solution treatment. The hardening response of various nickel-tin contents to tempering heat treatments are illustrated in Figs. 9 and 10. A diagram designed to summarize all of the important features of the heat treatment of Ni-Vee bronze and put an end to any more diagrams, is shown in Fig. 11.

There is an indication that the Ni-Vee constituent contains an equal quantity of nickel and tin because equal amounts above 2 per cent of each progressively strengthen and harden the metal. In this respect, it resembles the carbon effect in steels which at low carbon levels represent soft, weak steels, and at higher levels (approximately 0.85 per cent carbon), reach their greatest strength and hardness. At this carbon level, the microstructure of steels contains 100 per cent of the compound pearlite which is clearly visible. The precipitate in the nickel-tin bronze, in comparison, is almost invisible and would occupy a much smaller percentage of the structure (Fig. 2).

The quantity of precipitate increases with greater nickel-tin contents and progressively improves the tensile properties. The action reaches its peak at 8 per cent nickel and 8 per cent tin. At these high concen-



WEIGHING A CASTING: Resistance wire strain gages were used to weigh this 35-ton steel casting at Baldwin Locomotive Works, Philadelphia. The gages are bonded to short vertical columns incorporated in three load cells of 50,000 lb capacity each, which were developed for accurate weighing of all kinds. The casting is a semirotor to be shipped to a hydro-electric plant in Canada

trations, the precipitate is still a small and almost imperceptible constituent in the microstructure, although the higher nickel content impedes coalescence and occasionally traps the constituent in the dispersed acicular form (Fig. 3). The rate of precipitation in the Ni-Vee alloys is slow at the low temperatures used, and, as in the case of steels, the presence of an excess of nickel retards the rate of reaction.

There is a clue to the existence of a compound with a 1-to-1 nickel-tin ratio, in the contour lines of Fig. 7. Line *N-V* drawn through the nose of each contour line, points to the probable presence of such a compound. Point *N* is at 2½ per cent nickel and 2½ per cent tin; point *Y* is at 5 per cent nickel and 5 per cent tin; point *Z* is at 7½ per cent nickel and 7½ per cent tin, and point *V* is at 10 per cent nickel and 10 per cent tin.

The quantity of the nickel-tin phase does not increase appreciably (Fig. 12) with increasing nickel contents above 8 per cent, and no purpose is served unless it be desired to obtain a whiter, harder, more stable or more heat and corrosion resistant product. The higher nickel content alloys in the cupro-nickel series, will be described in a later text.

There are many obscure corners in those facets of the theory of the constitution and heat-treatment of nickel-tin bronze to add to those discussed here. Time and diligent research will gradually reveal more clearly the limits and extent of solubility, the composition of the nickel-tin compound, the influence of alloys and similar modifying ingredients, and the time-charted mechanism of diffusion, solution, precipitation and coalescence which characterize this interesting family of copper-base alloys.

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5. Trade mark, registered U. S. Patent Office.

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Acid Open Hearth Research Association Inc., P.O. Box 1873, Pittsburgh 30, has issued a booklet describing the purposes, functions, and research work of the association. Completed research projects are discussed briefly, and a list of association publications is included.

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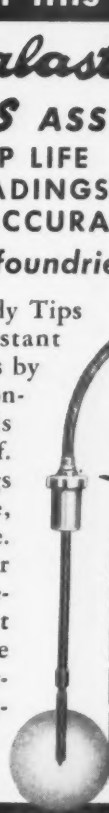

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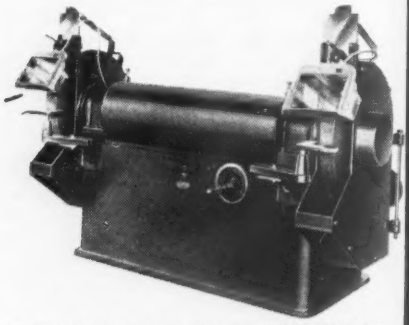

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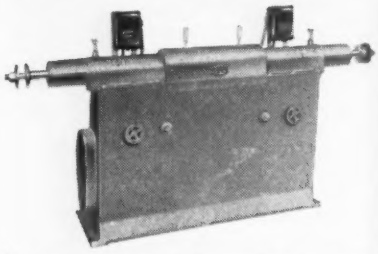

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HEAT TREATING: Surface Combustion Corp., 2375 Dorr St., P. O. Box 907, Toledo 1, O.—Vol. 1, No. 1 of *Heat Treat Review,* to be published periodically, presents current technical and operating information on heat treating metallurgy and practice. Metal melting and related metal processing activities also are to be covered.

CHAINS: Cleveland Chain & Mfg. Co., Broadway Ave. & Henry St., Cleveland 5—Bulletin SC-48 contains wrought iron sling chain safety rules and data on chain inspection, use and care. Recommended load limits are listed in detail for various chain sizes and suspension angles. Single and double sling chain specifications are presented in tabular form.

PALLET TRUCK: Towmotor Corp., Literature Dept., 1226 East 152nd St., Cleveland 10—Booklet describes and illustrates an improved model electric pallet truck. Dimensional specifications are included, and construction features explained. Component parts are discussed individually. A page is devoted to batteries and chargers.

BEARING MAINTENANCE: Anti-Friction Bearing Distributors Association, 1900 Euclid Ave., Cleveland 15—Vol. 1, No. 1 in a series of studies of bearing maintenance techniques and successful maintenance, installation, and removal procedures is offered. A file folder type of binder in which succeeding issues can be compiled also is furnished.

CORROSION PROTECTION: G. W. Smith & Sons Inc., 5400 Kemp Rd., Dayton 3, O.—Bulletin 50 describes a compound which may be brushed or sprayed on metal parts to protect them from corrosion for long periods of time. Compound also has qualities which prevent adhesion of weld spatter when parts require welding.

MOLDING MACHINES: SPO Inc., 6448 Grand Division Ave., Cleveland 5—Bulletin 30 presents detailed information and specifications on six standard models in the company's line of jolt pin lift molding machines. Operating on 80 psi line pressure, the machines have jolt capacities ranging from 750 to 4000 lb.

DUST CONTROL: Pangborn Corp., 1400 Pangborn Blvd., Hagerstown, Md.—Digest size, 50-page book offers detailed selection, operation, and maintenance data for the plant engineer responsible for dust control. The contents covers basic methods of accomplishing dust control, reasons why improperly planned dust collection installations do not perform their function fully, and analyze the three basic elements of dust control exhaust systems.

ELECTRIC DRILLS: Mall Tool Co., 7720 South Chicago Ave., Chicago 19—Booklet, "More Holes in a Hurry," provides a complete working knowledge of portable electric drills, their care, and how and where to use them. Reference tables and charts give drill sizes and speeds required to get a specific job done.

WELDING: Ampco Metal Inc., 1745 South 38th St., Milwaukee 46—Bulletin W-17 gives information on all bronze electrodes made by the company, recommended welding techniques, welding procedures, and machining suggestions. Charts cover bronze electrode selection, preheating, and weldability.

PORTABLE TOOLS: Skilsaw Inc., 5033 Elston Ave., Chicago 30—Illustrated catalog 50 describes the company's line of portable electric saws, sanders, drills, screwdrivers, nut runners, grinders, blowers, hammers, and related equipment and attachments. A section is devoted to pneumatic tools.

GRAPHITE: United States Graphite Co., 1621 Holland St., Saginaw, Mich.—Bulletins G-3 and G-4 discuss the use of graphite to supply carbon to acid and basic open-hearth charges, respectively. Method of use and addition amounts are outlined.

METAL COATING: Industrial Metal Protectives Inc., 401 Homestead Ave., Dayton 8, O.—Bulletin 100 describes a corrosion and abrasion resistant coating. Specifications for formulations, and data on surface preparation and methods of application are included.

LUBRICATION: Lincoln Engineering Co., 5701 Natural Bridge Ave., St. Louis 20—Catalog describes standardized, centralized, mass lubrication systems for varied industrial applications. Lubrication fittings, dispensers and guns are illustrated and described.

INSPECTION: Dy-Chek Co., Division of Northrop Aircraft Inc., 1515 East Broadway, Hawthorne, Calif.—Illustrated bulletin 500 describes a dye penetrant method of metal inspection. Dip, brush and spray methods are explained, and varied applications discussed.

DEOXIDIZER: Electro Refractories & Alloys Corp., 344 Delaware Ave., Buffalo 2—Bulletin D-850 deals with silicon carbide briquets for deoxidizing gray iron in the cupola. It

tells how to use the briquets and describes the benefits said to result from their use.

WELDING FLUXES: Eutectic Welding Alloys Corp., 40 Worth St., New York 13—Bulletin 106P gives details on a new line of welding fluxes. Data on application ranges, suggested metals use, governmental specifications, and other helpful information are included.

POWER TOOLS: Delta Power Tool Division, Rockwell Mfg. Co., 600 East Vienna Ave., Milwaukee 1—Catalog deals with metalworking and woodworking machines and other tools. Product specifications, prices, motor recommendations and accessory listings are included.

TRANSMISSION: Worthington Pump & Machinery Corp., Allspeed Drive Division, 37 Appelton St., Holyoke, Mass.—Bulletin AS-1600-B3 describes the company's 1-hp variable speed transmission. Specifications are included.

SCALES: Hydroway Scales Inc., 20624 West Eight Mile Rd., Detroit 19—Catalog-brochure describes the operation and applications of hydraulic crane scales. Pertinent dimensions of all standard models are tabulated.

EYE SAFETY: American Optical Co., Southbridge, Mass.—Revised issue of "AO Eye Safety Guide" lists eye-hazardous occupations and the recommended eye protection for specific industrial eye hazards.

MATERIAL HANDLING: Frank G. Hough Co., 703 Sunnyside Ave., Libertyville, Ill.—Job studies Nos. 10 and 17 show how two companies solved material movement and handling problems through use of the company's tractor-shovels.

HOISTS: Northern Engineering Works, 2615 Atwater St., Detroit 7—Booklet S-151 describes briefly the company's line of cranes and hoists and contains a list of users of overhead material handling equipment.

INSTRUMENTS: Wheelco Instruments Co., 847 West Harrison St., Chicago 7—Condensed catalog Z-6600 illustrates and briefly describes indicators, controllers, and combustion safeguards.

MOTORS: Allis-Chalmers Mfg. Co., 1032 South 70th St., Milwaukee—Illustrated bulletin 05B7550 gives construction features of large two-pole squirrel cage induction motors.

FURNACES: Surface Combustion Corp., 2375 Dorr St., P.O. Box 907, Toledo 1, O.—Bulletin SC-150 deals with heating and heat treating equipment for defense production.

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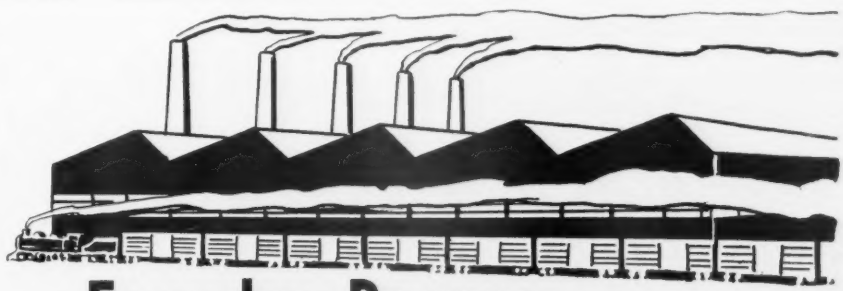

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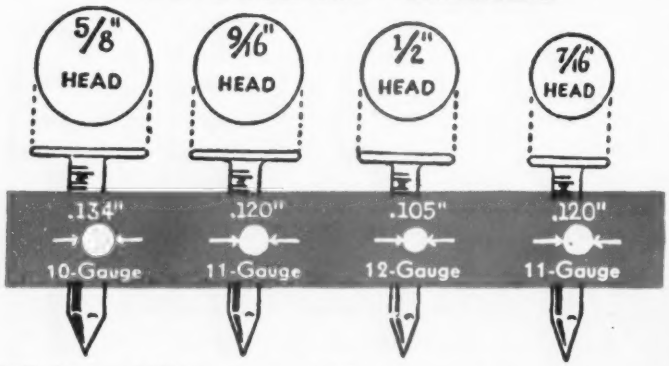

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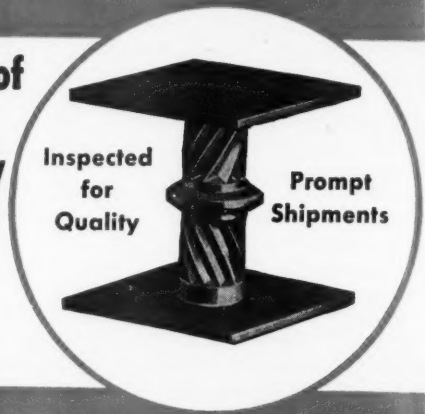

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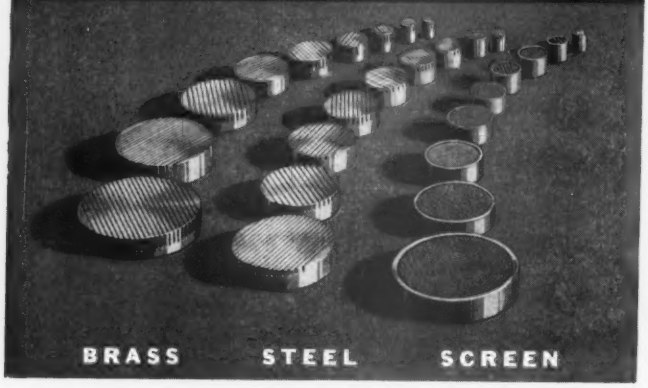

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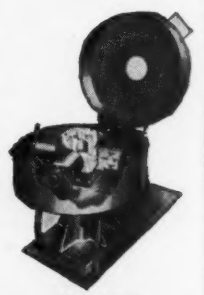

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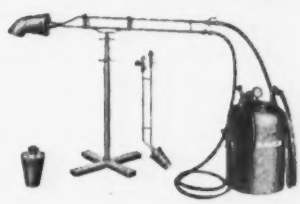

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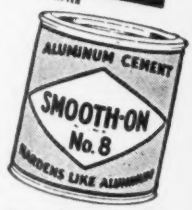

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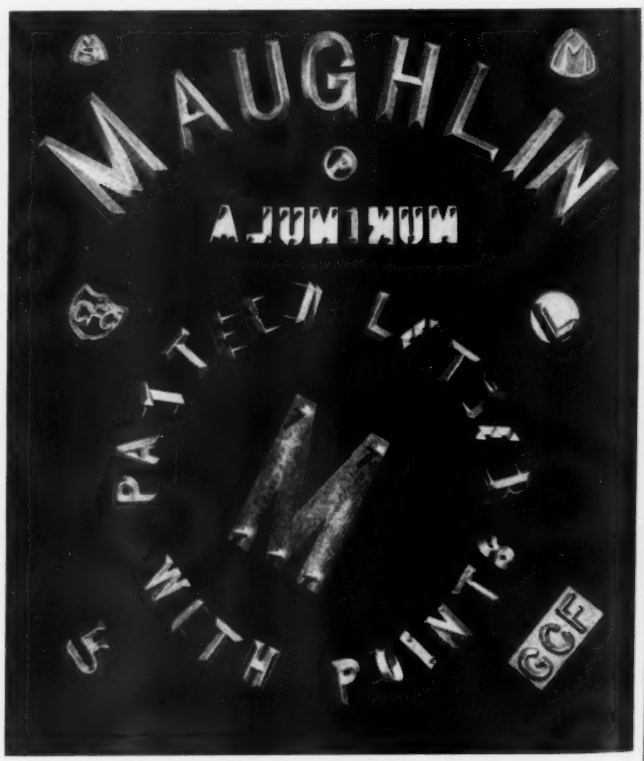

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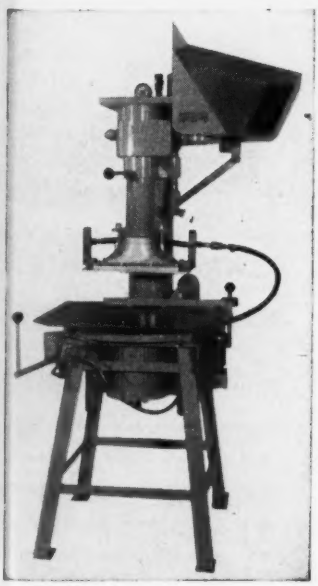

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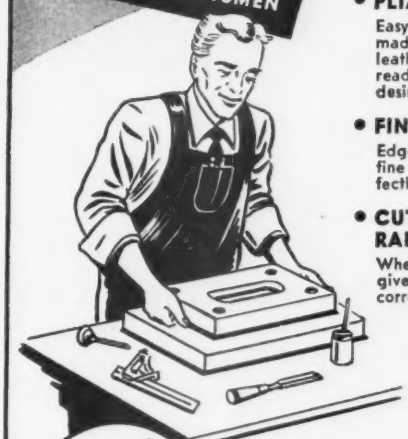

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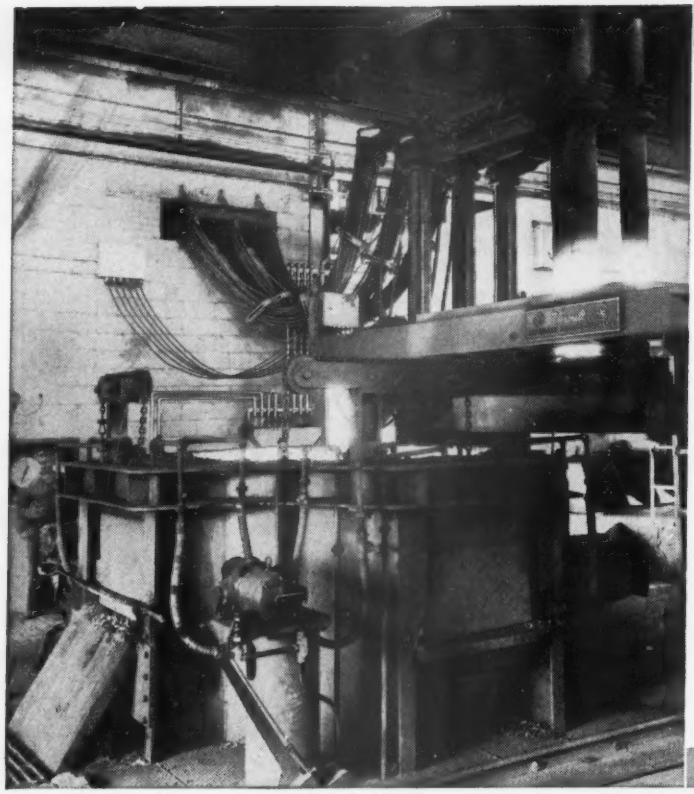

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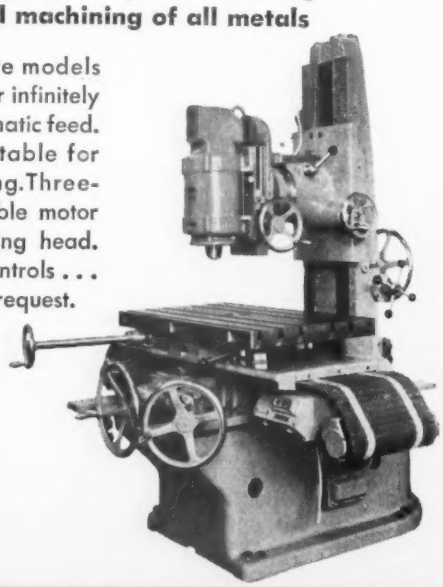

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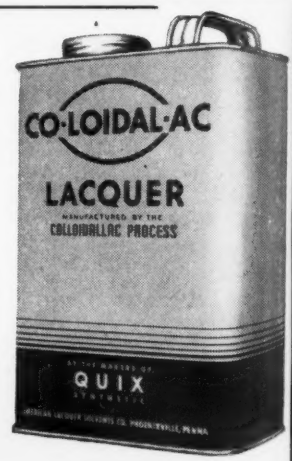

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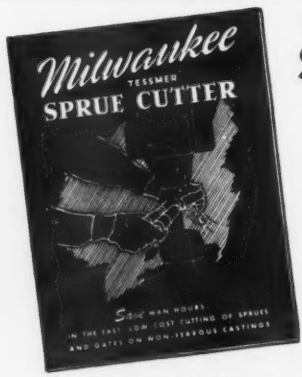

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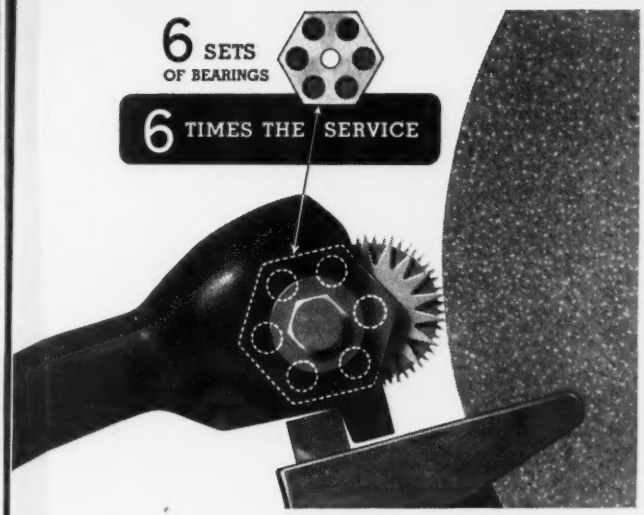

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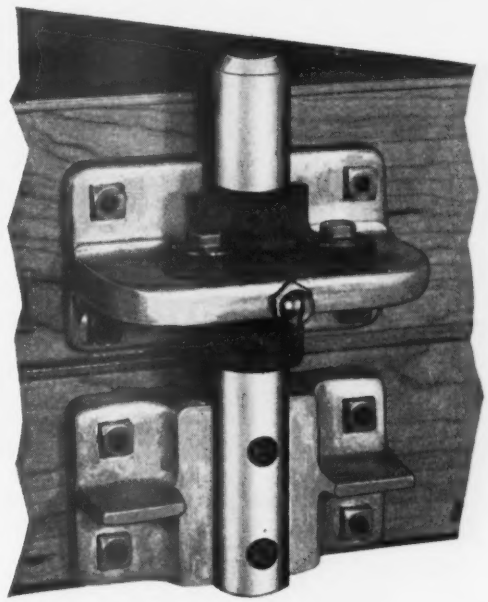

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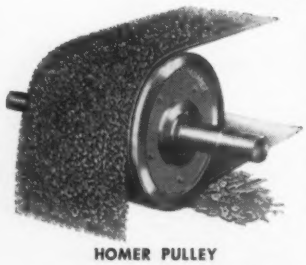

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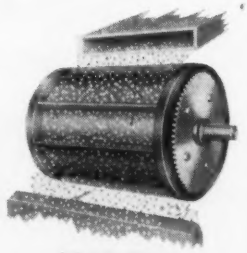

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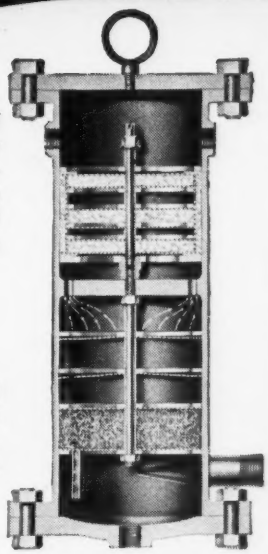

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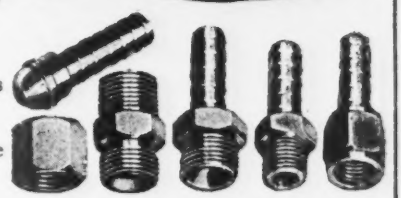

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Niagara Falls Smelting & Refining Div., Continental-United Industries Co., Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.
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Hickman-Williams & Co., Union Commerce Bldg., Cleveland 14, O.
Keokuk Electro Metals Co., Keokuk, Iowa
Miller & Company, 332 S. Michigan Ave., Chicago 4, Ill.
Ohio Ferro-Alloys Corp., Canton 2, Ohio
Titanium Alloy Mfg. Div., National Lead Co., Hyde Park Blvd., Niagara Falls, N. Y.
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Delta Oil Products Co., Milwaukee 9, Wis.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O
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Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

CORE FLUXES (Aluminum, Magnesium)

Pelron Corp., 7740 West 47th St., Lyons, Illinois

CORE GRINDERS (Power Operated)

Jeffrey Mfg. Co., Columbus 16, O

CORE GRINDERS (Power Operated) (Cont'd.)

Milwaukee Foundry Equipment Div., Spo Inc., 3328 Pierce St., Milwaukee 4, Wis.
Standard Pattern Works, 6771 E. McNichols, Detroit 12, Mich.
Sutter Products Co., Dearborn, Mich.

CORE KNOCKOUT MACHINES

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Pangborn Corp., Hagerstown, Md.
Simplicity Engineering Co., Durand, Mich.

CORE MAKING MACHINES

Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Wm. Demmler & Bros., Kewanee, Ill.
Federal Foundry Suppy Co., 4600 E. 71st St., Cleveland 5, O.
Harrison Machine Co., Wesleyville, Pa.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Milwaukee Foundry Equipment Div., Spo Inc., 3328 Pierce St., Milwaukee 4, Wis.
Redford Iron & Equipment Co., 20733 Glendale Ave., Detroit 23, Mich.
Sutter Products Co., Dearborn, Mich.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
Wadsworth Equipment Co., 555 Lafollette St., Akron, Ohio.

CORE OILS

Archer-Daniels-Midland Co., Werner G Smith Div., 2191 W. 110th St., Cleveland 2, O.
Cities Service Oil Co., 3200 S. Western Ave., Chicago 8, Ill.
Delta Oil Products Co., Milwaukee 9, Wis.
E. F. Houghton Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Peiron Corp., 7740 West 47th St., Lyons, Illinois
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
Frederic B Stevens, Inc., Detroit 26, Mich.
United Oil Mfg. Co., 1429 Walnut St., Erie, Pa
Werner G. Smith, Inc., Union Commerce Bldg., Cleveland 14, Ohio.

CORE OVENS

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, O.
Despatch Oven Co., Minneapolis 14, Minn.
Drying Systems, Inc., 1801 Foster Ave., Chicago 40, Ill.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, O.
Girdler Corp., Thermex Division, 224 E. Broadway, Louisville 2, Ky.
Haynes Foundry Equipment Co., 814 Ada St., Kalamazoo, Mich.
Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Mich.
Kirk & Blum Mfg. Co., Cincinnati 25, O.
Lanly Company, 750 Prospect Ave., Cleveland 15, O.
Porbeck Mfg. Co., 2600 N. 9th St., St. Louis 6, Mo.
J. O. Ross Engineering Corp., 444 Madison Ave., New York 17, N.Y.
Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.

CORE PASTE

Corn Products Sales Co., 17 Battery Pl., New York 4, N. Y.
Delta Oil Products Co., Milwaukee 9, Wis.

CORE PASTE (Cont'd.)

Eastern Clay Products Co., Jackson, O.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Frederic B. Stevens, Inc. 18th St. & Vernor Highway, Detroit 16, Mich.

CORE PLATES (Magnesium)

Christiansen Corp., 1515 No. Kilpatrick, Chicago 51, Ill.

CORE PLATES (Steel, Asbestos)

Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 6, Mo.
Diamond Clamp & Flask Co., Richmond, Indiana
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.
Johns-Manville, 22 E. 40th St., New York 16, N. Y.
Pressure Match Plate Co., 1013 N. Front St., Philadelphia 23, Pa.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.

CORE ROD STRAIGHTENING and CUTTING MACHINERY

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

CORE SAND

American Silica Sand Co., Central Life Bldg., Ottawa, Ill.
Great Lakes Foundry Sand Co., United Artists Building, Detroit 26, Mich.
Standard Silica Corp., 209 So. LaSalle St., Chicago 4, Ill.
Titanium Alloy Mfg. Div., National Lead Co., Hyde Park Blvd., Niagara Falls, N. Y.
Weldron Silica Co., 38 So. Dearborn St., Chicago, Ill.

CORE SAND MIXERS

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Baker Perkins Inc., Saginaw, Mich.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Blystone Division, Standard Sand & Machine Co., 549 W. Washington Blvd., Chicago 6, Ill.
Clearfield Machine Co., Clearfield, Pa.
Federal Foundry Supply Co., 4600 E.71st St., Cleveland 5, Ohio.
Multiplex Machinery Corp., Elmore, Ohio.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Posey Iron Works Inc., Lancaster, Pa.
Royer Foundry & Machine Co., Kingston, Pa.

CORE SPRAYERS

Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.

CORE STRIPPERS

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

CORE TRAYS

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.

CORE TRUCKS

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Kirk & Blum Mfg. Co., Cincinnati 25, O.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

CORE VENTS

Demmler, Wm., & Bros., Kewanee, Ill.

CORE VENTS (Cont'd.)

Smillie, C. M. & Co., 1124 Woodward Heights Blvd., Ferndale 20, Mich.
United Compound Co., Inc., 328 South Park Ave., Buffalo 4, N. Y.

CORE WASH

Carborundum Co., Perth Amboy, N. J.
Cities Service Oil Co., 3200 S. Western Ave., Chicago 8, Ill.
Corn Products Sales Co., 17 Battery Pl., New York City 4.
Delta Oil Products Co., Milwaukee 9, Wis.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
E. F. Houghton Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
National Carbon Co., Inc., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
Stevens, Frederic B., Inc., Detroit 26, Mich.
Titanium Alloy Mfg. Div., National Lead Co., Hyde Park Blvd., Niagara Falls, N. Y.
United Oil Mfg. Co., 1429 Walnut St., Erie, Pa.
United States Graphite Co., Saginaw, Mich.

CORE WIRES

Crescent Brass & Pin Co., 5766 Trumbull Ave., Detroit, Mich.

CORES (Annealing)

Pressed Steel Co., Wilkes-Barre, Pa.

COUPLINGS (Air Line)

Cleco Division of Reed Roller Bit Co., Houston, Tex.
A. Schrader's Son, 470 Vanderbilt Ave., Brooklyn 17, N. Y.

CRANE LUBRICATING SYSTEMS

Blaw-Knox Co., Farmers Bank Bldg., Pittsburgh, Pa.

CRANES (Bucket)

Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Electric Tramrail)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.

CRANES (Electric Traveling)

American MonoRail Co., 13104 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Erie Steel Construction Co., Erie, Pa.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Shepard-Niles Crane & Hoist Corp., 360 Schuyler Ave., Montour Falls, N. Y.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Gantry)

Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Modern Equipment Co., Port Washington, Wis.
Wellman Engineering Co., 7000 Central Ave., Cleveland 4, O.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Hand Traveling)

American MonoRail Co., 13104 Athens Ave., Cleveland 7, Ohio.
Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Modern Equipment Co., Port Washington, Wis.

CRANES (Hand Traveling) (Cont'd.)

Shepard-Niles Crane & Hoist Corp., Montour Falls, N. Y.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Jib)

American MonoRail Co., 13104 Athens Ave., Cleveland 7, O.
Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Modern Equipment Co., Port Washington, Wis.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Monorail)

American MonoRail Co., 13104 Athens Ave., Cleveland 7, O.
Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Modern Equipment Co., Port Washington, Wis.
Shepard-Niles Crane & Hoist Corp., 360 Schuyler Ave., Montour Falls, N. Y.

CRANES (Self-Propelled)

Silent Hoist & Crane Co., 835 63rd St., Brooklyn 20, N. Y.

CRUCIBLES

American Crucible Co., North Haven, Conn.
Bay State Crucible Co., Taunton, Mass.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Lava Crucible Co., Pittsburgh, Pa
Ross-Tacony Crucible Co., Tacony, Philadelphia, Pa.
Vesuvius Crucible Co., Swissvale, Pa.

CRUCIBLE FURNACES

Ajax Electrothermic Corp., Trenton, N. J.
Campbell-Hausfeld Co., Harrison, O.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.

CRUCIBLE LIFTERS

Modern Equipment Co., Port Washington, Wis.

CRUCIBLE POURING DEVICES

Modern Equipment Co., Port Washington, Wis.

CRUSHERS (Core)

Simplicity Engineering Co., Durand, Mich.

CUPOLAS

Modern Equipment Co., Port Washington, Wis.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CUPOLA BLOWERS

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Buffalo Forge Co., Buffalo, N. Y.

CUPOLA BLOWERS (Cont'd.)

Roots-Connersville Blower Corp., Connersville, Ind.

Spencer Turbine Co., Hartford, Conn.

Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CUPOLA CHARGING MACHINES

American MonoRail Co., 13104 Athens Ave., Cleveland 7, O.

Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, O.

Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.

Modern Equipment Co., Port Washington, Wis.

Shepard-Niles Crane & Hoist Corp., Montour Falls, N. Y.

Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CUPOLA CONTROL EQUIPMENT

Edwin S. Carman, 1643 Lee Road, Cleveland 18, Ohio.

Foxboro Company, Foxboro, Mass.

CUPOLA DUST ARRESTORS

Schneible Co., Claude B., 2827—25th St., Detroit 16, Mich.

CUPOLA HOT BLAST EQUIPMENT

J. O. Ross Engineering Corp., 444 Madison Ave., New York 17, N.Y.

CUPOLA LININGS

Carborundum Co., Perth Amboy, N. J.

Cleveland Quarries Co., 1740 E. 12th St., Cleveland 14, O.

Ironton Fire Brick Co., Ironton, O.

United States Graphite Co., Saginaw, Mich.

CUPOLA PATCHING GUNS

Eastern Clay Products, Inc., Jackson, Ohio.

CUPOLA SPARK ARRESTORS

Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.

Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CUTOFF MACHINES (Abrasive)

Fox Grinders Inc., Oliver Bldg., Pittsburgh, Pa.

Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

CYLINDERS (Hydraulic)

Miller Motor Co., 4027 N. Kedzie, Chicago 18, Ill.

DARK ROOM ACCESSORIES (X-Ray)

Eastman Kodak Co., Rochester, N. Y.

General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

DARK ROOM PROCESSING (Chemical Tanks, etc.)

Eastman Kodak Co., Rochester, N. Y.

DEGASIFIERS

Metalloy Corp., Rand Tower, Minneapolis 2, Minn.

Pittsburgh Metals Purifying Co., 1352 Marvista St., Pittsburgh 12, Pa.

National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

Niagara Falls Smelting & Refining Div., Continental-United Industries Co., Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.

DEOXIDIZERS

Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.

Cleveland Flux Co., 1026 Main St., Cleveland 13, O.

Metalloy Corp., Rand Tower, Minneapolis 2, Minn.

Niagara Falls Smelting & Refining Div., Continental-United Industries Co., Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.

Pittsburgh Metals Purifying Co., 1352 Marvista St., Pittsburgh 12, Pa.

DEOXIDIZERS (Ferrous)

Carborundum Co., Perth Amboy, N. J.

DESULPHURIZERS

American Silica Sand Co., Central Life Bldg., Ottawa, Ill.

Cleveland Flux Co., 1026 Main St., Cleveland 13, O.

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

Hercules Powder Co., Wilmington 99, Del.

Mathieson Chemical Corp., 60 Mathieson Bldg., Baltimore 3, Md.

Modern Equipment Co., Port Washington, Wis.

Pittsburgh Metals Purifying Co., 1352 Marvista St., Pittsburgh 12, Pa.

Solvay Sales Division Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.

Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

DIE CASTING MACHINES

Kux Machine Co., 3930 W. Harrison St., Chicago 24, Ill.

Lester-Phoenix Inc., 2711 Church St., Cleveland 13, Ohio.

Miller-Taylor Tool Co., 5005 Euclid Ave., Cleveland 3, Ohio.

DIES

City Pattern Foundry & Machine Co., 1161 Harper, Detroit 11, Mich.

Lester-Phoenix Inc., 2711 Church St., Cleveland 13, Ohio.

DOWEL PINS

Standard Horse Nail Corp., New Brighton, Pa.

DRILLS (Electric)

Mall Tool Co., 7720 So. Chicago Ave., Chicago 19, Ill.

Standard Electrical Tool Co., 2488 River Road, Cincinnati 4, Ohio.

DRILLS (Pneumatic)

Gardner-Denver Co., Quincy, Ill.

Mall Tool Co., 7720 So. Chicago Ave., Chicago 19, Ill.

Schramm Inc., West Chester, Pa.

DRUMS (Magnetic)

Dings Magnetic Separator Co., 4740 Electric Ave., Milwaukee 7, Wis.

Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis.

DRYING OVENS

Drying Systems, Inc., 1801 Foster Ave., Chicago 40, Ill.

Porbeck Mfg. Co., 2600 N. 9th St., St. Louis 6, Mo.

DUMP HOPPERS

Roura Iron Works, 1405 Woodland Ave., Detroit 11, Mich.

DUMP TRUCKS

Frank G. Hough Co., Libertyville, Ill.

Kwik-Mix Co., Port Washington, Wis.

Prime Mover Co., Muscatine, Iowa.

DUST ARRESTING EQUIPMENT

American Air Filter Co., Inc., 266 Central Ave., Louisville 8, Ky.

American Wheelabrator & Equipment Co., Mishawaka, Ind.

Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, O.

Kirk & Blum Mfg. Co., Cincinnati 25, O.

Pangborn Corp., Hagerstown, Md.

Schneible Co., Claude B., 2827—25th St., Detroit 16, Mich.

W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

DUST COLLECTORS

American Wheelabrator & Equipment Co., Mishawaka, Ind.

American Air Filter Co., 266 Central Ave., Louisville 8, Ky.

Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland, O.

Kirk & Blum Mfg. Co., Cincinnati 25, Ohio

Pangborn Corp., Hagerstown, Md.

Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.

W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

DUST RECOVERY SYSTEMS

American Wheelabrator & Equipment Co., Mishawaka, Ind.

Kirk & Blum Mfg. Co., Cincinnati 25, O.

Pangborn Corp., Hagerstown, Md.

DYES & CHEMICALS

Eaton Chemical & Dyestuff Co., 1490 Franklin, Detroit, Mich.

ELECTRIC FURNACES (see Furnaces, Electric)

ELECTRODES (Graphite and Amorphous)

International Graphite & Electrode Corp., St. Marys, Pa.

National Carbon Co., Inc., Electrode Sales Div., 30 E. 42nd St., New York 17, N. Y.

ELEVATORS

Standard Conveyor Co., North St. Paul 9, Minn.

ELEVATORS (Bucket)

Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, O.

Jeffrey Mfg. Co., Columbus 16, O.

Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

Newaygo Engineering Co., Newaygo, Mich.

Robins Conveyors Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.

ELEVATORS (Pneumatic, Material Handling)

Fuller Co., Catasauqua, Pa.

ENGINEERING SERVICE (Foundry)

H. K. Ferguson, 1783 E. 11th St., Cleveland 14, Ohio.

Giffels & Vallet, Inc., Marquette Bldg., Detroit, Mich.

ENGINEERING SERVICE (Foundry) (Cont'd.)

Lester B. Knight & Associates, Inc., 600 West Jackson Blvd., Chicago 3, Ill.

A. H. Putnam Co., 1319 2nd Ave., Rock Island, Ill.

Westover Engineers, 424 E. Wells St., Milwaukee 2, Wis.

ENGINEERING SERVICE (Permanent Mold)

Industrial Pattern Works, 2625 West Belmont Ave., Chicago 18, Ill.

EXHAUST SYSTEMS

American Air Filter Co., Inc., Louisville 8, Ky.

American Wheelabrator & Equipment Co., Mishawaka, Ind.

Kirk & Blum Mfg. Co., Cincinnati 25, Ohio

Pangborn Corporation, Hagerstown, Md.

Schneible Co., Claude B., 2827 25th St., Detroit 16, Mich.

W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

FABRICATORS (Metal)

Kirk & Blum Mfg. Co., Cincinnati 25, Ohio

Roura Iron Works, 1405 Woodland Ave., Detroit 11, Mich.

FACINGS

Delta Oil Products Co., Milwaukee 9, Wis.

Joseph Dixon Crucible Co., Monmouth St., Jersey City, N. J.

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

National Carbon Co., Inc., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.

Stevens Inc., Frederic B., Detroit 16, Mich.

United States Graphite Co., Saginaw, Mich.

FANS (Ventilating, Exhaust, Cooling, etc.)

American Wheelabrator & Equipment Co., Mishawaka, Ind.

Hartzell Propeller Fan Co., Piqua, Ohio

Joy Mfg. Co., La Del Division, New Philadelphia, Ohio.

Pangborn Corp., Hagerstown, Md.

FEEDERS (Rotary)

Fuller Company, Catasauqua, Pa.

Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

Newaygo Engineering Co., Newaygo, Mich.

FEEDERS (Sand)

Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, O.

Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, O.

Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

FERROBORON

Electro Metallurgical Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

Molybdenum Corp. of America, Pittsburgh 19, Pa.

FERROCHROME

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St. New York 17, N. Y.

Hickman-Williams & Co., Cleveland, O.

Ohio Ferro-Alloys Corp., Canton 2, O.

Vanadium Corp., of America, 420 Lexington Ave., New York, N. Y.

FERROCOLUMBIUM

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

FERROMANGANESE

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

Ohio Ferro-Alloys Corp., Canton 2, O.

FERROMOLYBDENUM

Climax Molybdenum Co., 500 Fifth Ave., New York 18, N. Y.

Molybdenum Corporation of America, Pittsburgh 19, Pa.

FERROSILICON

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

Jackson Iron & Steel Co., Jackson, O.

Keokuk Electro Metals Co., 429 So. 4th St., Keokuk, Iowa.

Miller & Company, 332 S. Michigan Ave., Chicago 4, Ill.

Ohio Ferro-Alloys Corp., Canton 2, O.

Vanadium Corp. of America, 420 Lexington Ave., New York, N. Y.

FERROTITANIUM

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

Titanium Alloy Mfg. Div., National Lead Co., Hyde Park Blvd., Niagara Falls, N. Y.

Vanadium Corp. of America, 420 Lexington Ave., New York, N. Y.

FERROTUNGSTEN

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

Molybdenum Corp. of America, Pittsburgh 19, Pa.

FERROVANADIUM

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

Vanadium Corp. of America, 420 Lexington Ave., New York, N. Y.

FILLET (Leather)

Milwaukee Leather Belting Co., 1114 No. Water St., Milwaukee, Wis.

FILM (X-Ray)

Eastman Kodak Co., Rochester, N. Y.

General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

FILTERS (Air)

American Air Filter Co., 266 Central Ave., Louisville 8, Ky.

FIRE BRICK

Babcock & Wilcox Co., 85 Liberty St., New York 6, N. Y.

Carborundum Co., Perth Amboy, N. J.

Electro Refractories & Alloys Corp., Vars Building, Buffalo 2, N. Y.

Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.

FIRE BRICK (Cont'd.)

Illinois Clay Products Co., Joliet, Ill.

Mexico Refractories Co., Mexico, Mo.

Norton Co., Worcester 6, Mass.

Stevens Inc., Frederic B., Detroit 16, Mich.

FIRE CLAY

Eastern Clay Products, Inc., Jackson, O.

Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.

Illinois Clay Products Co., Joliet, Ill.

Ironton Fire Brick Co., Ironton, O.

FIRE SAND

Carborundum Co., Niagara Falls, N. Y.

Cleveland Quarries Co., 1740 E. 12th St., Cleveland 14, O.

FIRESTONE

Cleveland Quarries Co., 1740 E. 12th St., Cleveland 14, O.

FLASK BANDS

Chicago Mfg. & Distributing Co., 1928 W. 16th St., Chicago 9, Ill.

Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

FLASK BUSHINGS

Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 6, Mo.

Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.

Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

Universal Engineering Co., Frankenmuth, Mich.

FLASK PINS

Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 6, Mo.

Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.

Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

Universal Engineering Co., Frankenmuth, Mich.

V-G Flask & Fitting Co., Box 467, Madison, Conn.

FLASKS (Aluminum, Magnesium)

Adams Co., Dubuque, Iowa.

Diamond Clamp & Flask Co., Richmond, Indiana

Fremont Flask Co., Fremont, O.

Hines Flask Co., 3431 W. 140th St., Cleveland 11, O.

FLASKS (Dowmetal)

Fremont Flask Co., Fremont, O.

Hines Flask Co., 3431 W. 140th St., Cleveland 11, O.

FLASK FILLERS

Bartlett & Snow, C., C., Co., 6201 Harvard Ave., Cleveland 5, O.

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.

Jeffrey Mfg. Co., Columbus 16, O.

FLASKS (Slip)

Adams Co., Dubuque, Iowa.

Diamond Clamp & Flask Co., Richmond, Ind.

FLASKS (Slip) (Cont'd.)

Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.

Fremont Flask Co., Fremont, O.

Hines Flask Co., 3431 W. 140th St., Cleveland 11, O.

Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.

FLASKS (Snap)

Adams Co., Dubuque, Iowa.

Diamond Clamp & Flask Co., Richmond, Ind.

Fremont Flask Co., Fremont, O.

Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

Stevens, Inc., Frederic B., Detroit 16, Mich.

V-G Flask & Fitting Co., Box 467, Madison, Conn.

FLASKS (Steel)

Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 6, Mo.

Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.

Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.

Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.

FLASK FITTINGS

Adams Co., Dubuque, Iowa.

Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 6, Mo.

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.

Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.

V-G Flask & Fitting Co., Box 467, Madison, Conn.

FLASK LIFT MACHINES

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.

Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

FLASK LUMBER

Dougherty Lumber Co., 4300 E. 66th St., Cleveland 5, O.

Rietz Lumber Co., 1810 N. Central Park Ave., Chicago, Ill.

FLASKS (Wood)

Adams Co., Dubuque, Iowa.

Chicago Mfg. & Distributing Co., 1928 W. 16th St., Chicago 9, Ill.

Diamond Clamp & Flask Co., Richmond, Ind.

V-G Flask & Fitting Co., Box 467, Madison, Conn.

FLOORING (Non-Slip)

Norton Co., Worcester 6, Mass.

FLUXES

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Milwaukee Foundry Equipment Div., Spo Inc., 3328 Pierce St., Milwaukee 4, Wis.
Nicholls, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

MOLDING MACHINES (Rollover)

Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Johnston & Jennings Div., Pettibone-Mulliken Corp., 2424 No. Cicero Ave., Chicago 39, Ill.
Milwaukee Foundry Equipment Div., Spo Inc., 3328 Pierce St., Milwaukee 4, Wis.

MOLDING MACHINES (Rollover) (Cont'd.)

Milwaukee Foundry Equipment Div., Spo Inc., 3328 Pierce St., Milwaukee 4, Wis.
Nicholls, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Sutter Products Co., Dearborn, Mich.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

MOLDING MACHINES (Squeeze)

Adams Co., Dubuque, Iowa.
Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Haynes Foundry Equipment Co., 814 Ada St., Kalamazoo, Mich.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Johnston & Jennings Div., Pettibone-Mulliken Corp., 2424 No. Cicero Ave., Chicago 39, Ill.
Milwaukee Foundry Equipment Div., Spo Inc., 3328 Pierce St., Milwaukee 4, Wis.
Nicholls, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

MOLDING SANDS

American Silica Sand Co., Central Life Bldg., Ottawa, Ill.
Foundries Materials Co., Coldwater, Mich.
Great Lakes Foundry Sand Co., United Artists Building, Detroit 26, Mich.
Ottawa Silica Co., Ottawa, Ill.
Standard Silica Corp., 209 So. LaSalle St., Chicago 4, Ill.
Wedron Silica Co., 38 So. Dearborn St., Chicago, Ill.

MOLYBDENUM

Molybdenum Corporation of America, Pittsburgh 19, Pa.

MONOGRAMS & TRADE MARKS

H. P. Maughlin Co., 953 Ingleside Ave., Columbus, Ohio.

MONORAIL SYSTEMS

American Monorail Co., 13104 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Modern Equipment Co., Port Washington, Wis.

MOTORS (Electric)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Ohio Electric Mfg. Co., 5906 Maurice Ave., Cleveland, Ohio.

NAILS (Chill)

Angell Nail & Chaplet Co., 4580 E. 71st St., Cleveland 5, O.
Crescent Brass & Pin Co., 5766 Trumbull Ave., Detroit, Mich.
Republic Steel Corp., 3100 E. 45th St., Cleveland 4, Ohio.
Standard Horse Nail Corp., New Brighton, Pa.

NICKEL

International Nickel Co., Inc., 67 Wall St., New York City 5.

NITROGEN

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

NOZZLES (Blasting)

Alloy Metal Abrasives Co., 311 W. Huron St., Ann Arbor, Mich.
American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Davenport Machine & Foundry Co., Davenport, Iowa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Norton Co., Worcester 6, Mass.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

OIL BURNERS

Hauck Manufacturing Co., 106 Tenth St., Brooklyn 15, N. Y.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.

OPEN HEARTH DOORS

Wm. M. Bailey Co., Pittsburgh 16, Pa.

OVENS (Annealing and Heat Treating)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Lanly Company, 750 Prospect Ave., Cleveland 15, O.
Lindberg Engineering Co., Fisher Furnaces Div., 2450 West Hubbard, Chicago 12, Ill.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

OVENS (Core) (See CORE OVENS)

OVENS (Enameling, Japanning)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Kirk & Blum Mfg. Co., Cincinnati 25, Ohio
Lanly Co., 750 Prospect Ave., Cleveland 15, Ohio.

OVENS (Mold Drying)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Kirk & Blum Mfg. Co., Cincinnati 25, Ohio
Lanly Co., 750 Prospect Ave., Cleveland 15, Ohio.

OXYGEN

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

PAINTS (Graphite)

Joseph Dixon Crucible Co., Monmouth St., Jersey City, N. J

PARTING COMPOUNDS

Delta Oil Products Co., Milwaukee 9, Wis.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
E. F. Houghton Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.

PARTING COMPOUNDS (Cont'd.)

Frederic B. Stevens, Inc., Detroit 16, Mich.
Tamms Industries Inc., 228 N. LaSalle St., Chicago 1, Ill.

PATTERN COATINGS

American Lacquer Solvents Co., Phoenixville, Pa.

PATTERN COMPOUND

Tamms Industries Inc., 228 N. LaSalle St., Chicago 1, Ill.

PATTERN LETTERS

Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.
H. P. Maughlin Co., 953 Ingleside Ave., Columbus, Ohio.

PATTERN LUMBER

Dougherty Lumber Co., Cleveland 5, O.
Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.
Rietz Lumber Co., 1810 N. Central Park Ave., Chicago, Ill.

PATTERNMAKER'S VISES

Columbian Vise & Mfg. Co., 9021 Bessemer Ave., Cleveland, Ohio.

PATTERN METAL

Federated Metals Division of American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.
Niagara Falls Smelting & Refining Div., Continental-United Industries Co. Inc., 2204 Elmwood Ave., Buffalo 17, New York.

PATTERN PLATES

Accurate Match Plate Co., 1847 W. Carroll St., Chicago, Ill.
Buffalo Pattern Works, 830 Hertel Ave., Buffalo, N. Y.
Central Pattern Co.,
City Pattern Foundry & Machine Co., 1161 Harper, Detroit 11, Mich.
Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Industrial Pattern Works, 2625 West Belmont Ave., Chicago 18, Ill.
Plaster Process Castings Co., 6922 Carnegie Ave., Cleveland 3.
Scientific Cast Products Corp., 1388-92 E. 40th St., Cleveland 3, O.

PATTERN SHOP EQUIPMENT

Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.
Kurt Orban Co., 21 West Street, New York 6, N. Y.
Milwaukee Leather Belting Co., 1114 No. Water St., Milwaukee, Wis.
Oliver Machinery Company, Grand Rapids 2, Mich.

PATTERNS (Plastic)

Central Pattern Co., Quincy, Ill.

PATTERNS (Wood, Metal)

Accurate Match Plate Co., 1847 W. Carroll St., Chicago, Ill.
Buffalo Pattern Works, 830 Hertel Ave., Buffalo, N. Y.
Central Pattern Co., Quincy, Ill.
City Pattern Foundry & Machine Co., 1161 Harper, Detroit 11, Mich.
Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

PATTERNS (Wood, Metal) (Cont'd.)

Industrial Pattern Works, 2625 West Belmont Ave., Chicago 18, Ill.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Wellman Bronze & Aluminum Co., 2525 E. 93rd St., Cleveland 4, O.

PERMANENT MOLDS

Centrifugal Casting Machine Co., Tulsa, Okla.
Reserve Machine & Tool Co., 10026 Detroit Ave., Cleveland, Ohio.

PHOSPHOR COPPER

Federated Metals Division of American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.
Niagara Falls Smelting & Refining Div. Continental-United Industries Co. Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.

PHOTOGRAPHIC EQUIPMENT

Eastman Kodak Co., Rochester, N. Y.
General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

PHOTOGRAPHY (Industrial)

Eastman Kodak Co., Rochester, N. Y.

PIG CASTING MACHINES

Wm. M. Bailey Co., Pittsburgh 16, Pa.

PIG IRON

Hickman-Williams & Co., Union Commerce Bldg., Cleveland 14, O.
Jackson Iron & Steel Co., Jackson, Ohio.
Keokuk Electro Metals Co., 429 So. 4th St., Keokuk, Iowa.
Miller & Company, 332 S. Michigan Ave., Chicago 4, Ill.
Pickands, Mather & Co., Cleveland 14, O.
Republic Steel Corp., 3100 E. 45th St., Cleveland 4, Ohio.
Woodward Iron Co., Woodward, Ala.

PIG IRON (Silvery)

Jackson Iron & Steel Co., Jackson, O.
Keokuk Electro Metals Co., 429 So. 4th St., Keokuk, Iowa.
Miller & Company, 332 S. Michigan Ave., Chicago 4, Ill.

PINS (Flask)

Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Shanafelt Mfg. Co., 3623 Winfield Way, N.E., Canton 5, Ohio.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.
Universal Engineering Co., Frankenmuth, Mich.
V-G Flask & Fitting Co., Box 467, Madison, Conn.

PISTON RINGS (for Molding Machines, Compressors, etc.)

Nicholls, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.

PLANT ENGINEERING SERVICE

H. K. Ferguson Co., 1783 E. 11th St., Cleveland 14, Ohio.
Giffels & Vallet, Inc., Marquette Bldg., Detroit, Mich.
Lester B. Knight & Associates, Inc., 600 West Jackson Blvd., Chicago 3, Ill.

PLATES (Bottom)

Adams Co., Dubuque, Iowa.
Christiansen Corp., 1515 No. Kilpatrick, Chicago 51, Ill.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

PLATES (Core Drying)

Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Christiansen Corp., 1515 No. Kilpatrick, Chicago 51, Ill.
Johns-Manville, 22 East 40th St., New York 16.

PLUMBAGO

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Frederic B. Stevens, Inc., Detroit 16, Mich.
United States Graphite Co., Saginaw, Mich.

PNEUMATIC TOOLS

Arrow Tools Inc., 1900 S. Kostner, Chicago, Ill.
Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas.
Dayton Pneumatic Tool Co., Dayton 1, Ohio.
Gardner-Denver Co., Quincy, Ill.
Independent Pneumatic Tool Co., Aurora, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Master Pneumatic Tool Co., Inc., Orwell, Ohio.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.
Schramm Inc., West Chester, Pa.

POLISHING MACHINES

Bradford Machine Tool Co., 659 Evans St., Cincinnati, Ohio.

POURING DEVICES

Industrial Equipment Co., Minster, Ohio.
Modern Equipment Co., Port Washington, Wis.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

PRESSER BOARDS

Adams Co., Dubuque, Iowa.
Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Christiansen Corp., 1515 No. Kilpatrick, Chicago 51, Ill.
V-G Flask & Fitting Co., Box 467, Madison, Conn.

PRESSURE RECORDERS

Foxboro Company, Foxboro, Mass.

PROTECTIVE MATERIALS (X-Ray)

General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

PULLEYS (Magnetic)

Dings Magnetic Separator Co., 4740 Electric Ave., Milwaukee 7, Wis.
Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis.

PUMPS

Construction Machinery Co., Waterloo, Iowa.
Gardner-Denver Co., Quincy, Ill.

PUMPS (Dry, Vacuum)

Allis Chalmers Mfg. Co., Milwaukee 1, Wis.
Fuller Company, Catasauqua, Pa.
Roots-Connersville Blower Corp., Connersville, Ind.

PURIFIERS

Cleveland Flux Co., 1026 Main St., Cleveland 13, O.

PUSH-OFF MACHINES

Beardsley & Piper Co., 2424 N. Cicero, Chicago 39, Ill.
Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
International Molding Machine Co., LaGrange Park, Ill.
Milwaukee Foundry Equipment Div. Spo Inc., 3238 W. Pierce St., Milwaukee 4, Wis.

PUTTY (Foundry)

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

PYROMETERS

Elematic Equipment Corp., 1150 W. Marquette, Chicago 2, Ill.
Foxboro Company, Foxboro, Mass.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
Claude S. Gordon Co., 3000 So. Wallace, Chicago 16, Ill.
Illinois Testing Laboratories, Inc., 418 N. LaSalle St., Chicago 10, Ill.
Marshall Co., L. H., 270 W. Lane, Columbus 1, O.
Pyrometer Instrument Co., Bergenfield, N. J.
Tamms Industries Inc., 228 N. LaSalle St., Chicago 1, Ill.

PYROMETERS (Immersion)

Pyrometer Instrument Co., Bergenfield, N. J.

PYROMETERS (Optical)

Pyrometer Instrument Co., Bergenfield, N. J.

RACKS (Core Ovens)

Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Kirk & Blum Mfg. Co., Cincinnati 25, Ohio

RADIOGRAPHY (Industrial)

Eastman Kodak Co., Rochester, N. Y.
Eldorado Mining & Refining Ltd., P.O. Box 379, Ottawa, Ont.
Radium Chemical Co., Inc., 570 Lexington Ave., New York 22, N. Y.

RADIUM

Eldorado Mining & Refining Ltd., P.O. Box 379, Ottawa, Ont.
Radium Chemical Co., Inc., 570 Lexington Ave., New York 22, N. Y.

REFRACTORIES

Babcock & Wilcox Co., 85 Liberty St., New York 6, N. Y.
Carborundum Co., Niagara Falls, N. Y.
Carborundum Co., Perth Amboy, N. J.
Cleveland Quarries Co., 1740 E. 12th St., Cleveland 14, O.
Joseph Dixon Crucible Co., Monmouth St., Jersey City, N. J
Eastern Clay Products, Inc., Jackson, O.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.
Ironton Fire Brick Co., Ironton, O.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Mexico Refractories Co., Mexico, Mo.
Norton Co., Worcester 6, Mass.
Richard C. Remmey Son Co., Hedley St. & Delaware River, Philadelphia 37, Pa.

REFRACTORIES (Cont'd.)

Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.
Titanium Alloy Mfg. Div., National Lead Co., Hyde Park Blvd., Niagara Falls, N. Y.
United States Graphite Co., Saginaw, Mich.

REGULATORS (Gas or Oil)

The North American Mfg. Co., 4455 E. 71st St., Cleveland 4, Ohio.

RESPIRATORS

Wilson Products Inc., Reading, Pa.

RIDDLES (Electric)

Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Foundry Supplies & Mfg. Co., 2221 Orchard St., Chicago 14, Ill.
Great Western Mfg. Co., Leavenworth, Kans.

RIDDLES (Hand)

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.

ROD DIP

Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.

ROD STRAIGHTENERS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

ROLLER-HEARTH FURNACES (Electric Annealing)

General Electric Co., Schenectady, N. Y.
Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Mich.

RUBBER LINING MATERIAL (Abrasive Resisting)

Pangborn Corp., Hagerstown, Md.

SAFETY CLOTHING

American Optical Co., Southbridge, Mass.
B. F. McDonald Co., 5112 South Hoover St., Los Angeles 37, Calif.
Pangborn Corp., Hagerstown, Md.

SAND ARRESTER TUBES

Martin Engineering Co., Kewanee, Ill.

SAND (Core, Molding, Blasting)

American Silica Sand Co., Central Life Bldg., Ottawa, Ill.
Carpenter Brothers, Inc., 606 West Wisconsin, Milwaukee 3, Wis.
Great Lakes Foundry Sand Co., United Artists Building, Detroit 26, Mich.
Ottawa Silica Co., Ottawa, Ill.
Pangborn Corp., Hagerstown, Md.
Producers Core Sand Corp., Michigan City, Ind.
Standard Silica Corp., 209 So. LaSalle St., Chicago 4, Ill.
Titanium Alloy Mfg. Div., National Lead Co., Hyde Park Blvd., Niagara Falls, N. Y.
Wedron Silica Co., 38 So. Dearborn St., Chicago, Ill.

SAND BLAST BARRELS

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

SAND BLAST CABINETS

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

SAND BLAST EQUIPMENT

American Air Filter Co., 266 Central Ave., Louisville 8, Ky.
American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

SAND BLAST NOZZLES

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Norton Company, Worcester 6, Mass.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

SAND BLAST ROOMS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

SAND BLAST TABLES

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

SAND CONTROL & TESTING EQUIPMENT

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

SAND CONVEYING and HANDLING EQUIPMENT

American Air Filter Co., Louisville 8, Ky.
C. O. Bartlett & Snow Co., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Clearfield Machine Co., Clearfield, Pa.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Frank G. Hough Co., Libertyville, Ill.
Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Joy Mfg. Co., Joy Division, Pittsburgh, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Newaygo Engineering Co., Newaygo, Mich.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Penn Iron Works, Reading, Pa.
Royer Foundry & Machine Co., Kingston, Pa.

SAND CONVEYING and HANDLING EQUIPMENT (Pneumatic)

Fuller Company, Catasauqua, Pa.
Robins Conveyors Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.

SAND COOLING SYSTEMS

Newaygo Engineering Co., Newaygo, Mich.

SAND DRYERS

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, Ohio.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y.

SANDERS (Pneumatic)

Cleco Division of Reed Roller Bit Co., Houston, Texas.

SANDING MACHINERY (Disc, Spindle, Belt, etc.)

Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
Oliver Machinery Company, Grand Rapids 2, Mich.

SAND MEASURING and WEIGHING DEVICES

Baker Perkins Inc., Saginaw, Mich.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

SAND MIXERS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Baker Perkins Inc., Saginaw, Mich.
Beardsley & Piper Co., The, 2424 N. Cicero, Chicago 39, Ill.
Blystone Division, Standard Sand & Machine Co., 549 W. Washington Blvd., Chicago 6, Ill.
Clearfield Machine Co., Clearfield, Pa.
Construction Machinery Corp., Waterloo, Iowa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, Ohio.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Multiplex Machinery Corp., Elmore, Ohio.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Royer Foundry & Machine Co., Kingston, Pa.

SAND PREPARATION EQUIPMENT

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
Baker Perkins Inc., Saginaw, Mich.
Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The, 2424 N. Cicero, Chicago 39, Ill.
Clearfield Machine Co., Clearfield, Pa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, Ohio.
Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Moulders Friend, Dallas City, Ill.
National Engineering Co., 549 W Washington St., Chicago 6, Ill
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Royer Foundry & Machine Co., Kingston, Pa.
Simplicity Engineering Co., Durand, Mich.

SAND RAMMERS

Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas

SAND RAMMERS (Cont'd.)

Dayton Pneumatic Tool Co., Dayton 1, O.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
Master Pneumatic Tool Co., Inc., Orwell, Ohio.
Rotor Tool Co., 17325 Euclid Ave. Cleveland 12, Ohio.

SAND RECLAIMERS

Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W Washington St., Chicago 6, Ill.
Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y.
Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis

SAND SIFTING and SCREENING MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
American Air Filter Co., Louisville 8, Ky.
Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, Ohio.
Beardsley & Piper Co., The, 2424 N. Cicero, Chicago 39, Ill.
Champion Foundry & Machine Co 1553 W. Madison St., Chicago 7, Ill.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5,
Foundry Supplies & Mfg. Co., 2221 Orchard St., Chicago 14, Ill
Great Western Mfg. Co., Leavenworth, Kansas.
Link Belt Co., 300 W. Pershin Rd., Chicago 9, Ill.
National Engineering Co., 549 W Washington St., Chicago 6, Ill.
Royer Foundry & Machine Co., Kingston, Pa.
Simplicity Engineering Co., Durand, Mich.
Pangborn Corp., Hagerstown, Md
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill

SAND STORAGE BINS & GATES

Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, Ohio.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Jeffrey Mfg. Co., Columbus 16, O
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W Washington St., Chicago 6, Ill.

SAWS (Band, Metal, Wood)

Atlantic Saw Mfg. Co., New Haven, Conn.
Oliver Machinery Company, Grand Rapids 2, Mich.

SAWS (Cold Metal)

Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

SCALES

Toledo Scale Co., Toledo, Ohio

SCALING HAMMERS

Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.
Schramm, Inc., West Chester, Pa.

SCREENS (Shake-Out)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Barlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, Ohio.

SCREENS (Shake-Out) (Cont'd.)

Beardsley & Piper Co., 2424 N. Cicero, Chicago 39, Ill.
Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16. O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Simplicity Engineering Co., Durand, Mich.

SCREENS (Vibrating)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Robins Conveyors Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.
Simplicity Engineering Co., Durand, Mich.

SEA COAL

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Frederic B. Stevens, Inc., Detroit 16, Mich.

SEPARATORS (Abrasive)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

SEPARATORS (Air, Moisture, Oil)

American Air Filter Co., Louisville 8, Ky.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
A. Murphy & Co., Hamilton, O.
Pangborn Corp., Hagerstown, Md.
Schrader's Son, 470 Vanderbilt Ave., Brooklyn 17, N. Y.

SEPARATORS (Magnetic)

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Dings Magnetic Separator Co., 4740 Electric Ave., Milwaukee 7, Wis.
Homer Mfg. Co., Lima, Ohio.
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Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
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New Haven Vibrator Co., 131 Chesnut St., New Haven 7, Conn.
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Alloy Metal Abrasive Co., 311 W. Huron St., Ann Arbor, Mich.
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Steel Shot & Grit Co., Inc., 39 Warren Ave., Boston, Mass.

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American Wheelabrator & Equipment Co., Mishawaka, Ind.
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Cleveland Metal Abrasive Co., 887 E. 67th St., Cleveland, Ohio.
Globe Steel Abrasive Co., Mansfield, Ohio.
Metal Blast, Inc., 871 E. 67th St., Cleveland, Ohio.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., Pittsburgh 1, Pa.
Steel Shot & Grit Co., Inc., 39 Warren Ave., Boston, Mass.

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SNAGGING WHEELS—See ABRASIVE WHEELS

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Diamond Clamp & Flask Co., Richmond, Ind.
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Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
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Illinois Testing Laboratories, Inc., 418 N. LaSalle St., Chicago 10, Ill.
Marshall Co., L. H., 270 W. Lane, Columbus 1, O.
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—When writing advertisers, please mention FOUNDRY*—*

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ALUMINUM ALLOYS

An old and well established AAA-1 Aluminum Smelter located in the midwest is looking for an experienced salesman to sell aluminum alloys and deoxidizing shapes to foundries, steel mills and other industries. The salesman wanted is already an experienced and top notch producer in this field. Please furnish complete details regarding personal status, education, background of experience, compensation requirements and attach small snapshot if possible. Salary with automobile furnished. May be necessary to relocate.

Also interested in a draft exempt sales trainee who has decided to make selling his career. Prefer an engineering background with some training in metallurgy. Please furnish same data requested above.

BOX 410

THE FOUNDRY CLEVELAND 13, OHIO

SUPERINTENDENT

For malleable foundry located in New York state. State age, experience and salary requested. Replies will be held in confidence. Address: Box 392, FOUNDRY, Cleveland 13, Ohio.

MANAGER—ASSISTANT TO PRESIDENT

Steel, iron, brass. Thoroughly experienced in every shop operation, metallurgy, engineering, accounting and management. Excellent ability to develop a superior organization by leading, teaching and example. Outstanding reputation for keen analysis, sound judgement and a rare combination of practical experience, managerial ability and effective personality. Address: Box 375, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY FOREMAN

Able to read blue prints; estimate costs for quotation purposes from blue prints; set up jobs in foundry; set up production molding rates; also as field man to select jobs for foundry. Must be well qualified. Address: Box 319, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERVISOR

For a gray iron foundry in Western Pennsylvania melting 10 to 15 tons per day. Thorough experience in cupola operation, molding and core room practice, sand control and chilled castings. We operate our own pattern shop. Please give personal experience, history, availability and salary expected. Address: Box 233, FOUNDRY, Cleveland 13, Ohio.

WANTED

Practical man experienced in all phases of green sand nonferrous job-shop practice. Must have supervisory experience. In reply state age, experience and salary expected. Foundry located in Middle West.

BOX 238

FOUNDRY CLEVELAND 13, OHIO

METALLURGICAL ASSISTANT

For New England foundry producing iron, steel, bronze. Applicant should have at least 2 years' experience. Good opportunity for advancement. Send full particulars. Address: Box 400, FOUNDRY, Cleveland 13, Ohio.

MECHANICAL ENGINEER

Large grey iron foundry in Western Pennsylvania has opening for young mechanical engineering graduate to train for metal pattern supervisory position. Excellent opportunity in a wide open field. Include all personal data, qualifications and photograph. All replies confidential. Interview will be arranged. Address: Box 384, FOUNDRY, Cleveland 13, Ohio.

Help Wanted

MOLDING FOREMAN

Cleaning room foreman and trouble-shooter with grey iron foundry experience wanted for permanent position in mechanized foundry. Producing automotive castings, located in Middle West. Excellent opportunity with large, reputable manufacturing concern. Write stating experience, qualifications and expected salary. Address: Box 341, FOUNDRY, Cleveland 13, Ohio.

STEEL FOUNDRY MAN

OPPORTUNITIES FOR EXPERIENCED SUPERVISORS IN ALL OPERATING DEPARTMENTS AND MECHANICAL TRADES OF LARGE STEEL FOUNDRY. GOVERNMENT OWNED DEFENSE PLANT IN CHICAGO AREA TO BE OPERATED ON ARMOR STEEL CASTINGS. COMPANY OPERATING SET-UP SUFFICIENTLY LARGE AND AGGRESSIVE TO AFFORD PERMANENT OPPORTUNITY TO MEN WHOSE PERFORMANCE PROVES TO BE OUTSTANDING.

BOX 323

FOUNDRY CLEVELAND 13, OHIO

NONFERROUS FOUNDRY FOREMAN

In a foundry that works between 50 and 60 employees. Must be a core maker and molder, know the melting room and able to handle men. A middle aged man preferred. A real position in a growing firm and in a good progressive town with good schools and churches. Please state age, church affiliation and experience plus references in answering. Address: Box 379, FOUNDRY, Cleveland 13, Ohio.

EXPERIENCED FOUNDRYMAN

Midwestern gray iron foundry desires experienced man capable of supervising production and assembly of small to medium sized cores. Must be able to teach and coordinate making of cores on benches and coreblowers. In replying please state age, experience and salary expected. Address: Box 302, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Thorough experience in gray iron foundry required. Must have technical knowledge and ability in all phases of foundry work. Company located in Indiana. State age and experience. Furnish picture. Replies held confidential. Address: Box 366, FOUNDRY, Cleveland 13, Ohio.

GENERAL FOUNDRY FOREMAN

Steel foundry in New England producing small and medium sized carbon and alloy castings has opening for General Foreman. Please state age, experience and salary desired in reply. Interview can be arranged. All replies kept confidential. Address: Box 311, FOUNDRY, Cleveland 13, Ohio.

CLEANING ROOM FOREMAN

Steel foundry in New England producing small and medium sized carbon and alloy castings has opening for cleaning room foreman. Please state age, experience and salary desired in reply. Interview can be arranged. All replies kept confidential. Address: Box 312, FOUNDRY, Cleveland 13, Ohio.

MANAGER OR SUPERINTENDENT

EXPERIENCED GRAY IRON FOUNDRY MAN

To operate and supervise entire operation of small captive foundry of large corporation, located in central South. Must have full knowledge of all phases of operation, including loam and floor moulding, cupola operation, etc. In reply please state age, salary expected, experience and when available.

BOX 343

221 W. 41ST ST. NEW YORK 1, N. Y.

FOUNDRY FOREMAN

Experienced on aluminum castings for airplane engine work. Must have a thorough knowledge of this branch of casting work; also know how to handle men. Foundry located in New York City. Operate with 12 molders. Steady job and high salary for right party. Write, giving age, references and past experience. Address: Box 386, FOUNDRY, Cleveland 13, Ohio.

Help Wanted

SALESMAN—FOUNDRY EQUIPMENT

Manufacturer of foundry equipment has unusual opportunity for the right man, who is serious about his future. Excellent possibilities for advancement. Good education, ability to organize and direct, experience and wide acquaintance ir foundry field necessary. Must know core blowing and core room practice. Give full details in first letter, including age, experience and references.

THE FEDERAL FOUNDRY SUPPLY COMPANY

ELMER DITTY—SECRETARY

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$10-$12,000 PER YEAR

Medium sized established New Jersey nonferrous foundry needs technical superintendent. Must be experienced in all foundry operations, including scheduling and costs. Age to 60. Submit complete resume of experience and education.

BOX F485

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MASTER MECHANIC

For well established mid-west foundry. State age, experience and reference in first letter. Address: Box 373, FOUNDRY, Cleveland 13, Ohio.

TOOL SUPERVISOR

Large grey iron foundry in Western Pennsylvania has opening for man to supervise all tool operations. Must be familiar with layout, tool design, jigs and fixtures, machining processes. Include all personal data, qualifications and photograph. All replies confidential. Interview will be arranged. Address: Box 383, FOUNDRY, Cleveland 13, Ohio.

CORE ROOM FOREMAN

With thorough knowledge of cores for jobbing malleable iron foundry. Must be capable supervisor. Located in Western Pennsylvania. Give experience, age, references and salary expected in application letter. Address: Box 388, FOUNDRY, Cleveland 13, Ohio.

MASTER MECHANIC

Experienced in foundry maintenance work. Location: Michigan. Give full details of experience, references and salary expected with application. Address: Box 374, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY ENGINEERS

Experienced in analysis of operations and layout and design of equipment for mechanization. Write stating experience, qualifications and expected salary. Address: Box 364, FOUNDRY, Cleveland 13, Ohio.

METAL PATTERN SHOP FOREMAN

Large grey iron foundry in Western Pennsylvania has opening for metal pattern shop foreman. Include all personal data, qualifications and photograph. All replies confidential. Interview will be arranged. Address: Box 382, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERVISOR

Wanted for Main Bay by one of largest jobbing gray iron shops in Midwest, castings up to 20 tons. Address: Box 301, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY FOREMAN

To supervise operation of three large jolt roll-over mold draw from pattern machines also three large jolt stripper pin lift machines, two large core blowers and one bench core blower. Must be practical molder and coremaker, understanding core assembly molds poured without flasks, able to instruct both experienced molders and coremakers and unexperienced personnel. Address: Box 291, FOUNDRY, Cleveland 13, Ohio.

CLASSIFIED ADVERTISING

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ACCOUNTS WANTED

A commission castings salesman with a number of desirable jobs for immediate placement is looking for two good iron foundries, one for production up to about 200 lbs. The other for quality job work upward of 2 ton. Clientele—only the most desirable accounts in Michigan, Indiana, Ohio and Western Pennsylvania. Address: Box 378, FOUNDRY, Cleveland 13, Ohio.

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Well established with automotive industry, wants quality line of castings for the state of Michigan. Address: Box 381, FOUNDRY, Cleveland 13, Ohio.

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FOUNDRY ADVISORY ENGINEER

Practical foundryman for consultations, your plant or mine. Have designed permanent molds since 1930 for ferrous and nonferrous castings such as washtubs, hollow ware, cylinders, shells.

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Positions Wanted

FOUNDRY MANAGER OR SUPERINTENDENT

Practical, progressive, 30 years' experience gray iron, semi-steel and malleable foundries. Capable of taking complete charge of all phases of any foundry—cost, sales, estimating from prints, rigging for high production, reduce scrap. Past 15 years in executive capacity. Good references, available at once. Address: Box 401, FOUNDRY, Cleveland 13, Ohio.

PLANT MANAGER OR FOUNDRY SUPERINTENDENT

Gray iron, twenty-eight years' experience, production or jobbing, mechanized or otherwise. Seventeen years in executive capacity and a background of specialized training in factory management. Age 46, excellent references and recommendations. Address: Box 357, FOUNDRY, Cleveland 13, Ohio.

SUPERINTENDENT OR ASSISTANT SUPERINTENDENT

Practical, with a technical education. 45 years old. Sixteen years as foreman and superintendent. Experienced in production of jobbing and machine tool castings. Well versed in cupola practice, cast iron analysis. Prefer East or South East. Address: Box 339, FOUNDRY, Cleveland 13, Ohio.

PLANT ENGINEER

Twenty-five years' experience of foundry mechanization in the engineering design, development, plant layout, equipment installation, maintenance and operation for reduced costs and increased production. Age 53 years, best references. Address: Box 351, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Practical jobbing foundryman desires change. Know all phases, cupola, rigging, sand control, core blowing, good labor relations record. Will consider any grey iron jobbing foundry producing light or medium work. 25 years' experience. 12 years' supervision. At present employed. Address: Box 880, FOUNDRY, Cleveland 13, Ohio.

GRAY IRON FOUNDRY SUPERINTENDENT

Young man, 34, desires position in medium or small foundry where he can build a future. Excellent academic background. Strong in costs, labor relations, mechanization (machine molding, core blowing, etc.) cupola operation, sand control and general foundry operations. Weak in very large and pit molding. Available on reasonable notice. Address: Box 387, FOUNDRY, Cleveland 13, Ohio.

MELTER, FOUNDRYMAN

Desires foundry or melt supervision. 25 years' experience in supervision of electric furnace, steel and iron. Available now. Address: Box 345, FOUNDRY, Cleveland 13, Ohio.

Positions Wanted

GENERAL FOREMAN

Desires position—gray iron or nonferrous, light jobbing, production, soil pipe, farm implements. Prefer western or central New York but not essential. Address: Box 354, FOUNDRY, Cleveland 13, Ohio.

MASTER MECHANIC—FOUNDRY ENGINEER

Practical and technical experience 25 years in modern foundries only. Supervisory capacity, preventive maintenance, layout and operation complete on high production system. All types of foundry operation, can take full charge. Employed now but will consider change with permanent firm. Address: Box 408, FOUNDRY, Cleveland 13, Ohio.

FOREMAN OR SUPERINTENDENT

Practical gray iron foundry man (making change) about May 1st, desires position as foreman and superintendent in production or jobbing. 35 years in foundry game from molder to superintendent. Practical on cupola mix by analysis all types of green or dry sand molding. Squeezer rollover and bumper. Good rigger for production. Good references. Address: Box 371, FOUNDRY, Cleveland 13, Ohio.

WEIGHT ESTIMATING

Estimating of casting weights furnished by return mail. Accurate, reliable and confidential service. Nominal fee. Send blueprints: Address: CHARLES E. ROLAND, 215 FOREST DRIVE, ITASCA, ILL.

PRODUCTION SUPERVISOR

Seeking position in Southern California area foundry. Five years' foundry experience covers quality control, cost, production planning and control, time and motion study and general foundry knowledge. Now employed in supervisory management capacity in leading midwest grey iron jobbing foundry. Age 26, college training, veteran, married, two children. References available. Address: Box 405, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT OR GENERAL FOREMAN

Large or small castings in gray iron or nonferrous, green or dry sand. 20 years' practical experience in all foundry details. New Jersey preferred. Address: Box 352, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY MANAGER OR SUPERINTENDENT

Experienced in all foundry supervision. Technically trained with 14 years' supervisory experience ranging from superintendent of 600 to owning small foundry. Experience in both grey iron or malleable iron. Age 39 years. Address: Box 402, FOUNDRY, Cleveland 13, Ohio.

PLANT SUPERINTENDENT

Twenty-five years' experience in jobbing and production of gray iron castings. Thirteen years in executive capacity. Production and sales promotion background in developing small foundries. Age 46, married, no dependents. Good health. Address: Box 406, FOUNDRY, Cleveland 13, Ohio.

MELTING SUPERINTENDENT OR ASSISTANT

Well qualified in all phases of basic electric stainless steel melting operation. Ten years stainless melting experience which includes five years as melting superintendent. Capable of melting monel, ni-resist and carbon steels. Prefer position on West Coast or Texas. At present employed. Address: Box 373, FOUNDRY, Cleveland 13, Ohio.

FOUNDRYMAN

Over 22 years of practical foundry experience in steel, iron and high-alloys. Well versed in modern practice. Have served from foreman to superintendent with excellent record. Employed—available on reasonable notice. Address: Box 356 FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Wants charge of gray iron foundry running 10 to 25 per day. 25 years' experience in jobbing and production. Good cupola control and sand-slinger operation. Age 46. Good health. Address: Box 407, FOUNDRY, Cleveland 13, Ohio.

SUPERINTENDENT

Desires position on West Coast as superintendent of a steel foundry. Know all phases for making steel castings. 22 years' experience as general foreman or superintendent. Can furnish the best of references. Address: Box 377, FOUNDRY, Cleveland 13, Ohio.

GENERAL MANAGER

Mature, profit-minded, dependable. Has successfully managed four companies—two taken out of the red. Available for service shortly with medium-size company requiring reliable directing ability in management, sales finance and production. Excellent experience, foundry, machine and related lines. Address: Box 235, FOUNDRY, Cleveland 13, Ohio.

METALLURGIST

Experienced all phases foundry work. Principally malleable, steel, stainless, alloy; some gray iron, nonferrous. Age 47. Young in ideas. Prefer Midwest. Address: Box 365, Foundry, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT OR GENERAL FOREMAN

35 years' practical experience. Nonferrous, aluminum and magnesium. Jobbing shop to mechanized systems. Good organizer of foremen. Thorough knowledge of mixes, commercial or government specifications. Best of references. 59 years old. Good health. Eastern states preferable. Address: Box 398, FOUNDRY, Cleveland 13, Ohio.

Consulting Service

CASTING CONSULTANT

FOUNDRY ENGINEER OF 15 YEARS' EXPERIENCE WILL DESIGN YOUR PRODUCTS FOR EFFICIENT FOUNDRY PRODUCTION. WILL PLACE YOUR CASTING REQUIREMENTS IF DESIRED. EXCELLENT DELIVERY GUARANTEED ON PATTERNS AND PERMANENT MOULDS. SEND PRINTS OR INQUIRIES AT NO OBLIGATION FOR PROMPT REPLY. ADDRESS: BOX 390, FOUNDRY, CLEVELAND 13, OHIO.

Available Capacity

AVAILABLE CAPACITY

Our foundry has open capacity to supply small and medium size gray iron castings. Send sample. Address: OREGON CASTINGS CO., RD 3, Lititz, Pa.

OPEN CAPACITY

PATTERN AND MOULD SERVICES. WE HAVE SAME OPEN CAPACITY FOR MATCH PLATE, COPE AND DRAG PATTERNS AND PERMANENT MOULDS. CAN GUARANTEE EXCELLENT DELIVERY. ADDRESS: BOX 389, FOUNDRY, CLEVELAND 13, OHIO.

OPEN CAPACITY

CASTING CAPACITIES. WE HAVE SOME OPEN CAPACITY FOR ALUMINUM PERMANENT MOULD CASTINGS. WE SPECIALIZE IN CASTINGS CONTAINING INSERTS. ADDRESS: BOX 391, FOUNDRY, CLEVELAND 13, OHIO.

OPEN FOUNDRY TIME

Large capacity available for small to medium size ferrous and nonferrous castings. Production heat treating facilities.

DONEGAL MANUFACTURING CORP.
635 E. MARKET MARIETTA, PENNSYLVANIA

Foundries For Sale

STEEL AND BRICK CONSTRUCTED BUILDING
24,000 Square Feet
Approximately Eight Acres of Land
Railroad Siding

Suitable For

GRAY IRON AND NON-FERROUS FOUNDRY

Available Immediately

LOCATED AT MINERAL RIDGE, OHIO
RIDGE CASTING DIVISION
HELLIER COAL & COKE COMPANY
1003 Union National Bank Bldg.
Youngstown, Ohio
Phone: Youngstown 4-5394

SMALL FOUNDRY FOR SALE

On New York Central Railroad side track in Lockport, New York. Floor space of molders approximately 11,000 square feet with exceptional dumping ground for disposal of slag and waste indefinitely at lowest expense over declivity on the land. Considerable foundry equipment thrown in for the price of assessed value of the real estate. Address: JEFFERSON UNION COMPANY, LOCKPORT, NEW YORK.

GRAY IRON FOUNDRY

FOR LEASE

C. EMRICH CO

127 W. FULTON ST. COLUMBUS, OHIO

GRAY-IRON FOUNDRY

Brick and steel foundry with two clear spaces 80 x 320 ft. with overhead monorail, story height 13 ft. 6 in., gable 23 ft., attached building 40 x 50 ft., story heights 15 ft. 6 in. and 13 ft. 4 in., has two No. 7 Whiting cupolas 72 in. in diameter. Contains equipment, ideal for mechanized operation, plenty dumping ground, built 1917, composition roof, vicinity population about 9000, near center of U. S. population, expect natural gas this year, served by two major railroads, water transportation available, city hydrant fire protection, land for expansion. Subject to withdrawal without notice. Address: Box 358, FOUNDRY, Cleveland 13, Ohio.

FOUNDRIES FOR SALE

SOIL PIPE FOUNDRY. Equipped to produce fittings. Located in South. Price $115,000.

BRASS & ALUMINUM FOUNDRY. Capacity 12 moulders. Room to expand.

IRON FOUNDRY. Well equipped for production work. Very profitable.

EDWARD H. ZOLL

INDUSTRIAL PROPERTIES THROUGHOUT THE EAST

790 BROAD ST. NEWARK 2, N. J.

FOUNDRY FOR SALE

Most profitable medium size jobbing foundry in this section of the country. Well equipped, situated between Cleveland and Detroit. Arranged for production. Deal involves $250,000.00. Owners must retire. Opportunity for user of castings with certificate of necessity. Address: Box 340, FOUNDRY, Cleveland 13, Ohio.

GRAY IRON FOUNDRY

Foundry with 32" Whiting cupola in Boston area being vacated due to expansion. Close to customers and raw materials. Very low local taxes. Address: Box 403, FOUNDRY, Cleveland 13, Ohio.

FOR SALE

Nonferrous foundry in large industrial town near Chicago. Capacity 2 ton aluminum and 2 ton brass per day. Have some government work. Price $50,000. Address: Box 395, FOUNDRY, Cleveland 13, Ohio.

FOR SALE

FOUNDRY AND MACHINE SHOP IN MINOT, N. DAKOTA

Foundry building 50' x 75' with charging room 16' x 20', located at end cleaning room 20' x 30' at side. Fully equipped to make castings up to one ton.
Machine and welding shop 30' x 40' with large lathe, drill presses, grinders and welding equipment.
Wood working and storage building 30' x 40'.
Office building 12' x 18'.
Situated on four large lots.
Priced to sell $40000.00.

MINOT FOUNDRY CO.
P. O. BOX 1442
MINOT, NO. DAKOTA

Employment Service

SALARIED PERSONNEL

$3,000-$25,000. This reliable service, established 1927, conducts confidential negotiations for high-grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Address: JIRA THAYER JENNINGS 241 ORANGE STREET, NEW HAVEN 10 CONN.

SHAY

—Operating Nationally Since 1914—

PARTIAL LIST OF OPEN POSITIONS

SUP'T. Ferrous or Non-Fer. To $ 9,600
MANAGER, Fdry., Mach. Shop To $12,000
Plant Engineers Master Mechanics
Industrial Engrs. Time Study Engrs
FOREMEN: Core, Pattern, Mold, Cupola.

SHAY AGENCY SUITE 907
30 W. WASHINGTON CHICAGO 2, ILLINOIS

SALARIED POSITIONS

$3,500 to $35,000. We offer the original personal employment service (established 41 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered; present position protected. Ask for particulars. Address: R. W. BIXBY, INC., 101 DUN BUILDING, BUFFALO 2, NEW YORK.

Wanted-To-Buy

WANTED

Sand blast parts or equipment.
Address: DIAMOND SALES, INC.
5654 WEST JEFF., DETROIT 9, MICH.

WANTED

1 (one) used No. 250 Stroman tilting furnace. Address: ENTERPRISE BRASS WORKS, MUSKEGON, MICH.

WANTED

New or used—direct arc electric furnace capacity —1000 to 2500 pounds per hour. Address: Box 394, FOUNDRY, Cleveland 13, Ohio.

Wanted-To-Buy

WANTED

Fifty 13 x 18 single pin steel flasks with 4" cope 3" drag. Address: Box 304, FOUNDRY, Cleveland 13, Ohio.

WANTED

10" and 13" SPO squeezers—late type—one each
20 HP Air Compressor—80-100# line pressure
400# ladle—worm drive
36" x 42" American Wheelabrator tumblast or equivalent
50 HP air compressor—100# line pressure

TRI-STATE PRODUCTS COMPANY
19 SEVENTEENTH STREET MAIN 6229
TOLEDO 2, OHIO

WANTED

Electric furnace 350 to 5000 lbs. For cast iron and steel. Give voltage, equipment, condition and price. ADDRESS: EMPIRE PATTERN & FOUNDRY CO., BOX 1647, TULSA, OKLAHOMA.

WANTED

Small gray iron foundry located within 100 miles of New York City. Owner may stay. Give complete information. Address: Box 409, FOUNDRY, Cleveland 13, Ohio.

WANTED

(one) used #30 G. R. International roll-over molding machine. Address: MR. R. SWAIN, WOODRUFF & EDWARDS, INC., ELGIN, ILLINOIS.

PATTERN EQUIPMENT

Cash for large or small lots of complete, new or used patterns and core boxes for the making of ferrous or nonferrous castings used in building, plumbing trades, hardware items, art goods or just about anything. Must be reasonable. Write prices, information to: Box 344, FOUNDRY, Cleveland 13, Ohio.

MIXERS WANTED

Used Simpson Intensive Sand Mixers. State size, condition and lowest cash price or immediate acceptance. Address Box 578, FOUNDRY, Cleveland 13, Ohio.

WANTED

Osborn 405 or 405-77 and 332 roll-out type molding machines. Address: FRANK FOUNDRIES CORP., MUNCIE, INDIANA.

WANTED
BLOWER

Positive type, Roots Connersville, capacity C.F.A.M. 12,000 and over. No. 7½ or 8. Address: SANITARY CO. OF AMERICA, LINFIELD, PA.

WANTED

Complete foundry equipment, including tumblast, sand cutter, miscellaneous molding machines and coreblowers. Send full description and prices to: FALL RIVER FOUNDRY, 1148 DAVOL STREET, FALL RIVER, MASS.

WANTED

1 only nonferrous melting furnace capacity 2,000 lbs. Address: MONTREAL BRONZE, LTD., 999 DELORIMIER AVE., MONTREAL 24, QUEBEC.

FOUNDRY
MACHINE SHOP
WANTED
IN MIDDLE EASTERN U. S.

By responsible large corporation. Heavy medium floor jobbing foundry with heavy medium machine shop capacity. Approximately 15 tons daily. Direct solicitations from owners preferred. Strictly confidential.

BOX FF603
221 W. 41st ST. NEW YORK 18, N. Y.

WANTED TO BUY

Tabor-squeeze stripping molding machine. Kindly state age, condition and price. Hines aluminum pop-off flasks in the following sizes:

12 x 20
12 x 23

Osborn #2 Core Blowing Machines or Demmler Equivalent in size.

NATIONAL FOUNDRY CO. OF NEW YORK, INC.
10 SANDFORD STREET
BROOKLYN 5, NEW YORK

CLASSIFIED ADVERTISING

Wanted-To-Buy

WANTED

One precision aluminum match plate flask approximately 24 x 36 with 5" cope 5" drag. Also one one-ton air hoist with 15 to 20 foot lift. State condition and price in first reply. Address: STEEL HEDDLE MFG. CO., GREENVILLE, S. C.

Opportunities

OPPORTUNITY

IN WASHINGTON STATE. Small owner-operated foundry, pattern-shop and machine shop needs associate foundryman (nonferrous) to take part or full ownership and management. Present owner will retire or remain in part time capacity. Business well established on permanent basis in live area. Opportunities unlimited. Moderate investment desirable. Fully secured. Complete details by return mail. State age, experience, etc. in first letter. References exchanged. Address: Box 385, FOUNDRY, Cleveland 13, Ohio.

For Sale

FOR SALE

MOLDING MACHINES
1—International Type GR Stationary 24 x 10
1—International Type RJ Stationary 14 x 8
1—International Type G Stationary 24 x 10
1—International Type R Portable 24 x 10
1—International Type F Stationary 26 x 8
2—Tabor Stationary Jolt Squeeze
1—International Type M Portable 24 x 10
1—Osborn 74W Plain Squeeze Portable
2—Osborn 75W Plain Squeeze Portable
4—Arcade 72-28 Jolt Squeeze Stationary
2—SPO #305 Jolt Strippers
2—SPO #611B Stationary Oscillating Jolt Squeeze Strippers
1—SPO #4½ JHS Jolt Hand Strip
BLOWERS FOR CUPOLAS AND FURNACES
2—15 HP Spencer Turbine 2250 CFM @ 16-oz
1—Connersville rotary 24 cu. ft. per rev. 6200 C.F.M.
Maxon-Premix Blowers for Gas ¼ to 1 HP
METAL MELTING EQUIPMENT
1—V-bail worm gear Crane Ladle 38" dia. 38" deep, 6000# cap.
1—Hausfeld 2000# aluminum capacity furnace, barrel type, open flame, oil fired
New 32" to 41" dia. shell cupolas made to order.
TUMBLING MILLS AND SAND BLAST
1—Pangborn style GJ-1 rotoblast barrel complete with Pangborn style FM automatic loader. Load capacity approx. 16 cu. ft.
1—Pangborn No. 2 GH direct pressure type sand blast barrel, motor driven. Complete unit.
1—Pangborn Sand Blast Unit, including generator tank, shot cleaner, bucket elevator. Suitable for use with room
MISCELLANEOUS
1—American Sand Cutter 72"
2—#16 Roto-clone units complete
1—Continuous Heat Treat Furnace 57' long. 1200° F. max.
2—Sly Economy #12 Cloth Screen Dust Collectors
25 Tons steel flasks in sizes from 26 x 26 to 60 x 60.
1—Demmler #1 Core Blower
1—9 x 8 Ingersoll Rand Air Compressor, with motor
4—Heavy Duty Flexible Shaft Grinders 2 HP
Complete stock of rebuilt mill and dust exhaust blowers

CLIFTON MACHINERY COMPANY
1023 W. SIXTH ST. CINCINNATI 3, OHIO

FOR SALE

1—Industrial ladle 6000 lb. capacity type ST worm geared with outside tea spout. Address: E. J. WOODISON CO., 7415 ST. AUBIN AVE., DETROIT 11, MICH.

FOR SALE

2—Osborn Jolt, Squeeze, Rollover, Draw Molding Machine
1—Besly 53" Surface Disc Grinder
Complete Steel Converter Production Equipment.

GUNITE FOUNDRIES CORPORATION
ROCKFORD, ILLINOIS

For Sale

FOR SALE

Whiting 7½ ton overhead crane. 58½ ft. span—lift 27 ft. Ser. 2289. Excellent condition—$11,000 loaded on flat car. Original owner.

MR. C. MACKPRANG
THE PYLE-NATIONAL CO.
1334 N. KOSTNER AVE.
CHICAGO 51, ILLINOIS

FOR SALE
FOUNDRY EQUIPMENT

1—9' LF-14 Pangborn Rotoblast Table
(The above machine may be seen in operation.)
2—Oxweld Type MP-5, 150# size. Acetylene Generators
1—Johnston and Jennings No. 918-B, Jolt Roll-over Pattern Draw, with Automatic Adjustable Rollout Conveyor.

CRUCIBLE STEEL CASTING COMPANY
LANSDOWNE, PENNA.
PHONE: AL 4-5200

VIBRATING FEEDERS

2—48 x 72 Jeffrey-Traylor vibrating feeders, size No. 5, heavy duty, with M-4 vibrators, complete with electrical equipment for 440 V., 3 ph., 60 cycle. Used very little.

DODGE MANUFACTURING CORP.
MISHAWAKA, INDIANA

FOR SALE

Two-sand and castings leak proof type apron conveyors
NEVER USED
1. 24" wide—horizontal centers about 24'-0"
2. 30" wide—conveyor centers 65'-0"
Both *COMPLETE* with motors 3/60/220 switches, head and take up shafts, sprockets, chaining, roller bearing pillow blocks, chain wheels.

ALBANY CASTINGS CO. INC.
VOORHEESVILLE, N. Y.

TUMBLING BARRELS

1—Whiting 4-ft. diam. 6-ft. long
1—Whiting 30" x 9-ft. long

(Complete with countershafts)

FAIRBANKS, MORSE & CO.
ST. JOHNSBURY, VERMONT

FOR SALE

Blower, Centrifugal 25 HP 1602 Pressure Capacity
Cupola 54 x 42
Drill Press
Grinder-Standard 6 HM Multiple Speed
Gyrator Riddle Type V 1/6 HP
Molding Machines—Jolt Squeezers—Rapid
Sand Tumblast Barrel—Mac Leod 36 x 36
Scales
Also miscellaneous equipment and supplies
Please write for prices

THE F. A. KLAINE COMPANY
FRONT & CENTRAL AVE.
CINCINNATI 2, OHIO PHONE CHERRY 3323

FOR SALE

One used Mott direct driven 8'-0" automatic rotary table with #4 H.L. sand blast machine. In good condition. Priced reasonable.

NEW HAVEN FOUNDRY
NEW HAVEN, MICHIGAN

FOR SALE
MOLDING MACHINE

1—International R E S—jolt, squeeze, rollover draw—14" cylinder—6" draw.
1—International P K L—jolt squeeze air pin lift—14" cylinder—5½ lift.

BOX 353
FOUNDRY CLEVELAND 13, OHIO

FOR SALE

One 74/50, Model AM, American sandcutter, equipped with 75-foot cable and crane bail. Motors—220-440 volts. Practically new. Address: Box 440, FOUNDRY, Cleveland 13, Ohio.

For Sale

FOR SALE

Pangborn "CH" DUST COLLECTOR
Serial #3889—5500 C.F.M.—9" Static Pressure—Cloth Covered Screens. 25 H.P.—220/440—3 Ph.-60 totally enclosed Allis-Chalmers Motor. Direct connected to exhaust fan. 23¾" Inlet—26¾" Outlet.
Motor driven Vibrating Screen Cleaner.
Four Compartment with individual Hoppers one of which is fitted with elevator for sand cleaning.
Overall dimensions: 8' x 8' x 30' if supports & hoppers removed.
Supporting angle iron structure will clear truck. Can be moved on highways or freight cars without dismantling.
Excellent condition. Price $2000.00 fob Cin'ti, O.
ALSO
MAGNETIC SEPARATOR Mfgr: Dings Magnetic Separator Can be used with DUST COLLECTOR. Size: 12" x 18"—110 V.—s.ph. Motor 2 hp. Ser. R5771. $600.00 fob Cin.. O.

PANGBORN BLAST PEENING CABINET
4 spindle automatic table equipped with BVR-7 Pangborn abrasive separator & bucket-belt elevator, 20 hp, 5 hp and 2 hp Motors included. $2000.00 fob.
Pangborn—SAND BLASTER Model 1AV11—$150.00 fob.
Demler No. 2 CORE MACHINE—air operated, $225.00 fob.
(1) Schramm Air Compressor 75 hp.
315 CFM, 110#, rebuilt, 60 cycle, water cooled, with radiator, 5 years old.
Pangborn tumblast—30" x 40" drum
Cranes—overhead & jib, all sizes
Hoists—electric, hand, air—1 to 10 ton
Air Compressors—from 1 hp up
Foundry Equipment. Send us your inquiries.

ALLIED MATERIALS HANDLING COMPANY
4657 SPRING GROVE, CINCINNATI 32, O.

STACKING MACHINES FOR SALE

Practically new, used about 2 months, 4 International stacking machines. Type JSK-7, jolt, squeeze, pin strip molding machines. Also, approximately 1200—13 x 26 aluminum stack flasks and 160—15 x 29 aluminum bottom boards. Address: BROOKS FURNACE CO., ALBION, MICH.

FOR SALE

Air Compressors—For Sale—3 PH./60 CY/220/440
Imperial Type 10, 2 Stage Ingersoll Rand, Air Compressors with new style Channel Valve Air Ends. Size 15" & 9¼" x 12", Complete with 75 H.P. motors, Starters, Vee Belt Drives & spare parts
Imperial type 10BD, 2 stage Ingersoll Rand, Air Compressor, size 14" & 9" x 12" complete with 75 H.P. motor, Starter, Vee Belt Drive & spare parts
Class "ER" single stage Ingersoll Rand, Air Compressor mounted on fabricated base, size 12" x 10", complete with 61 H.P. motor, Starter Vee Belt Drive & spare parts
Above can be inspected under full load service until July 1, 1951
Also Available
Ingersoll Rand Motorblower, Type FS-355, 6,000 C.F.M. 1 Lb. Per Sq. In. Pressure at 3500 R.P.M., complete with 40 H.P. direct connected motor, constant air weight control Mechanism & 16" motor operated Blast Gate.

CENTRAL SPECIALTY DIV.,
720 NORRIS ST.,
YPSILANTI, MICHIGAN

EQUIPMENT FOR SALE

1—Osborn #405-77 Jolt Rollover Pattern Draw Oil Leveling Runout Car
4—Osborn #403 Jolt Rollover Pattern Draw
2—Osborn #332-38 Jolt Squeeze Rollover Draw
4—Osborn #275-JW Jolt Squeezers
2—Osborn #42 Jolt Hand Rockover Core Machines
1—Osborn #602 Jolt Rollover Pattern Draw
1—Davenport 48SA Jolt Rollover Pattern Draw Draw
1—Herman 1500 lb. Jolt Rollover Pattern Draw
1—Herman 3000 lb. Jolt Rollover Pattern Draw
2—International 27 x 16 Jolt Rollover Pattern Draw
1—Sly Centri-blast Wheel Type 8 Ft. Table. Excellent Condition
2—International Jolt Squeezers
3—Tabor Jolt Rollover Pattern Draw 30 x 40 Table
2—S.P.O. Jolt Squeeze Pin Lift Machines
3—Demmler #2 Core Blowers
12—Hand Rockover Core Machines—Various Sizes
1—Milwaukee #165 Jolt Squeeze Pin Lift
1—American Wheelabrator Tumblast 27 x 36. Excellent Condition.

BOX 393
FOUNDRY CLEVELAND 13, OHIO

For Sale

FOR SALE

1—#2 Simpson Mixer
17—275 JW Portable or Stationary molding machines
9—Walker York Stationary & Tilting Furnaces
1—500 Detroit Elec. Furnace complete with Transformer 2300—60
4—2047 Osborn Jolt Rollover molding machines
4—Nicholls Stationary Jolt Squeezers
30—Tabor Yoke Bar Stationary Plain Squeezers
10—1 ton open top worm geared ladles
1—Pangborn 40" Revolving Table Sand Blast Machine
1—Blaw Knox Clam Shell Bucket size 309F

UNIVERSAL MACHINERY & EQUIPMENT CO.
320 E. BROAD ST.
SHILLINGTON, READING, PA.
R. B. HARRISON,
MANAGER FOUNDRY DEPT.
PHONES READING 30311—40146

FOR SALE

ROLLOVER MOLDING MACHINES

Herman—Table—40" x 84"; Draw—36"—1944 Machine
Davenport—Model 2SSA—Cap. 2000 lbs. Flask Size 30" x 48"; Draw—12"
#405 Osborn—Flask Size 64" x 57"; 3000 lb. Jolt Capacity.
#918 Johnston & Jennings—Table—44" x 54" Pattern Draw—18"; Cap. 2000 lbs. No Pit Required
These are all government surplus machines and have not been used since World War II. Prices are less than one-half of replacement cost.

BALCHER MACHINERY COMPANY
1884 S. COMPTON ROAD
CLEVELAND HEIGHTS 18, OHIO
TEL: FAIRMOUNT 1-1186

FOR SALE

Osborn jolt rollover #602, for flasks 36" x 36" x 15-17" high, 10" draw, 600 lb. jolt capacity. Late type, excellent condition, immediate shipment. Address: TRIPLEX MACHINE TOOL CORP., 75 WEST STREET, NEW YORK 6, N. Y.

FOR SALE

Two aluminum match plates, one for 1¼" x 1½" New York regulation traps; other for ½" and ¾" sweat fittings, ells and tees, for copper pipe. Core boxes, dryers, wood masters, adapted for core blowing machines. Priced reasonably for let or singly. Address: Box 397, FOUNDRY, Cleveland 13, Ohio.

FOR SALE

40,000 super chills ⅜" x ¾" with 1½" shank 230 ft. ¾" x 5", 4 ply rubber belt. 100 Carborundum aloxite grinding wheels 6 x 1 x ⅞, grade 24-G-U 60. Address: LE TOURNEAU CO. OF GEORGIA, TOCCOA, GEORGIA.

FOR SALE
DETROIT ELECTRIC FURNACE

Model AA 1200 lb. capacity for cold melting, 2600 lb. capacity for duplexing. Complete with electrical breakers, buss bars, switch panels, transformers, compensators. Used approximately 9 months. This equipment is offered for sale as we have discontinued the type of work for which this furnace was purchased. Approximately $1200 worth of new linings and repair parts go with this furnace. Price $14,500.

NOBLESVILLE CASTING COMPANY, INC.
NOBLESVILLE, INDIANA

EQUIPMENT FOR SALE

Twin burner oil fired Sklenar melting furnace, 600# capacity—$850.00.
1—350# Detroit electric furnace, with bases and shells.
1—12000 volt primary 153 KVA, Kuhlman transformer.
1—low voltage switch for alternating between the two furnaces. All bus bars, meters, etc., for above $1200.00, complete, or will sell equipment piecemeal.

BUCK IRON COMPANY
ROUTE #1 QUARRYVILLE, PA.

FOR SALE

One 20 ton ladle. One 12 ton ladle. Both have worm gear tilt and are in excellent condition. Prices for quick sale because storage space at a premium. Address: Box 399, FOUNDRY, Cleveland 13, Ohio.

For Sale

FOR SALE

2 #2 Johnston & Jennings jolt squeeze and pin lift molding machines, table 24 x 30, almost new
1 Johnston & Jennings jolt pin lift table 38 x 30.
12 Assorted Osborn & Tabor molding machines, jolt and squeeze
1 Simpson #2, Muller style C just overhauled with new 15 H.P. motor
1 24 inch Magnetic pulley with motor generator set
1 D.C. 2 ton crane almost new with jig.

ALLIED FOUNDRY CO. INC.
2 PACIFIC AVE. JERSEY CITY, N. J.

FOR SALE

Moulder's Friend sand cutter in excellent shape—extra brush and spare parts included. Address: EDISON INDUSTRIES, INC., BOX 595, SOUTH MILWAUKEE, WISCONSIN.

SANDSLINGER FOR SALE

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Assorted patterns, arbors, pipe machine, special ladles and other equipment necessary for the manufacture of soil pipe and fittings. Address: J. F. QUEST FOUNDRY CO., 900 SOUTH 4th ST., MINNEAPOLIS 15, MINN.

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141 MANGIN STREET NEW YORK 2, N. Y.

FOR SALE

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cfm	Pressure	Make	Motor H.P.	Volts	Speed
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1000	32 oz.	Spencer	15	220	
900	24 oz.	Spencer	10	220/440	
225	10 oz.	Spencer	1	220/440	3600

PRESSURE BLOWERS (3 Phase, 60 Cycle)

2500	7 oz.	Sturtevant	15	220/440	1800
2400	14 oz.	Mahr	15	220/440	3480
1800	1 in.	Sturtevant	2	220/440	
1000	12 oz.	Nth.Amer.	5	220	3600
950	16 oz.	Nth.Amer.			
800	8 oz.	Nth.Amer.	3	220	3600
800	24 oz.	American	10	220	3600
667	8 lb.	AllenBillmyre	50	220	3560
450	6 lb.	A&B	30	220/440	3450
400	4.3 oz.	Spencer	2	220/3/60	3500
340	20 oz.	AllenBillmyre	3	440	3600
275	16 oz.	Nth.Amer.	2	220	3600
150	12 oz.	Nth.Amer.	1	220	3600

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1552 HAMILTON AVENUE

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FOR SALE

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1—Jeffrey Sand Conditioner, Portable
1—#9 Whiting Cupola with Blower
2—Chicago Pneumatic 1½ ton Air Hoists

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PHONE: CANAL 6-0314

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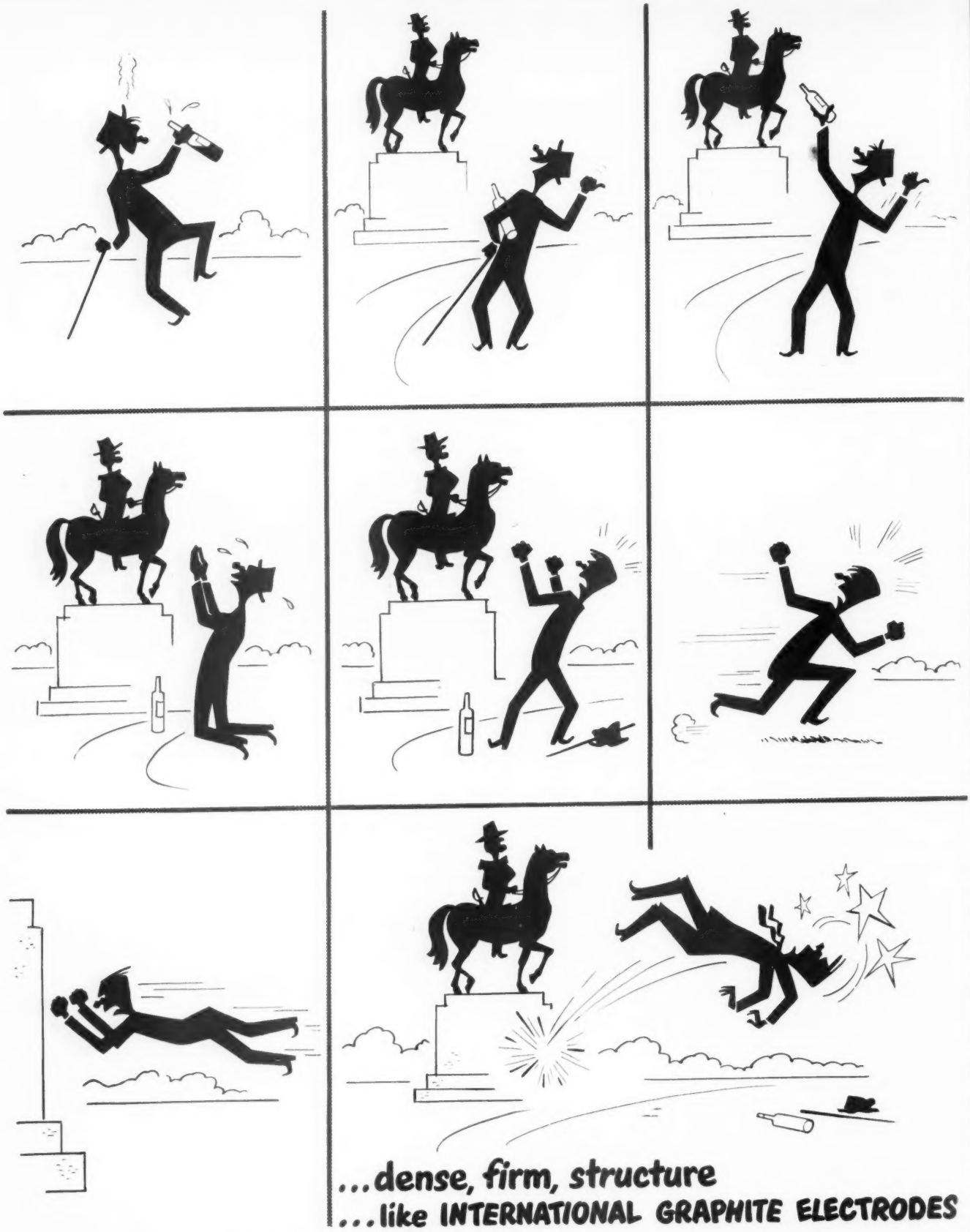

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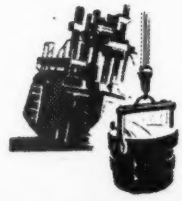

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